ENVIRONMENTAL SERVICES
SPB05-894P-KK

1. PARTIES

THIS CONTRACT, is entered into by and between the State of Montana, Department of Administration, State Procurement Bureau, (hereinafter referred to as "the State"), whose address and phone number are Room 165 Mitchell Building, 125 North Roberts, PO Box 200135, Helena MT 59620-0135, (406) 444-2575 and **Oasis Environmental**, (hereinafter referred to as the "Contractor"), whose nine digit Federal ID Number, address and phone number are 92-0155937, 482 Electric Ave Suite 5, Bigfork MT 59911, and (406) 837-0804.

THE PARTIES AGREE AS FOLLOWS:

2. PURPOSE

The purpose of this term contract is to establish a list of Environmental Service Providers in several service areas. All qualified offerors will be assembled into a multiple contractor term contract for use by state agencies and other public procurement units. The State makes no guarantee of use by any agency-authorized access to this term contract. However, through data conveyed by the Montana Department of Environmental Quality, Montana Department of Natural Resources and Conservation, and Montana Fish, Wildlife and Parks, it is anticipated that this term contract should access approximately 2.5 million dollars or more annually.

3. EFFECTIVE DATE, DURATION, AND RENEWAL

3.1 Contract Term. This contract shall take effect upon execution of all signatures, and terminate on June 30, 2009, unless terminated earlier in accordance with the terms of this contract. (Mont. Code Ann. § 18-4-313.)

3.2 Contract Renewal. This contract may, upon mutual agreement between the parties and according to the terms of the existing contract, be renewed in one-year intervals, or any interval that is advantageous to the State, for a period not to exceed a total of two additional years. This renewal is dependent upon legislative appropriations.

3.3 Addition of Analytical Laboratory Contractor. Proposals will be accepted between April 1 and May 1 of each calendar year from current firms requesting review of their qualifications to perform Analytical Laboratory Services as originally requested under RFP SPB05-894P. The state will evaluate each proposal received in the exact manner in which the original proposals for other categories were evaluated. If proposal passes the requirements as evaluated to perform Analytical Lab Services, the state will update that firms term contract to include the Analytical Lab Services category contingent on said firm being in good standing otherwise.

4. NON-EXCLUSIVE CONTRACT

The intent of this contract is to provide state agencies with an expedited means of procuring supplies and/or services. This contract is for the convenience of state agencies and is considered by the State Procurement Bureau to be a "Non-exclusive" use contract. Therefore, agencies may obtain this product/service from sources other than the contract holder(s) as long as they comply with Title 18, MCA, and their delegation agreement. The State Procurement Bureau does not guarantee any usage.

5. COOPERATIVE PURCHASING

Under Montana law, public procurement units, as defined in section 18-4-401, MCA, have the option of cooperatively purchasing with the State of Montana. Public procurement units are defined as local or state public procurement units of this or any other state, including an agency of the United States, or a tribal procurement unit. Unless the bidder/offeror objects, in writing, to the State Procurement Bureau prior to the award of this contract, the prices, terms, and conditions of this contract will be offered to these public procurement units.

6. TERM CONTRACT REPORTING

Term contract holder(s) shall furnish annual reports of term contract usage. Each report shall contain complete information on all public procurement units utilizing this term contract. Minimum information required to be included in usage reports: name of the agency or governmental entity who contacted you regarding a potential project; project title; agency contact person; if the project was not successfully negotiated, state the reason; number and title of contracts received; total dollar amounts for contracts received; the names of your company personnel involved in the project; and project status as of usage report date. The report for this term contract will be due on July 20th of each year.

Reported volumes and dollar totals may be checked by the State Procurement Bureau against State records for verification. Failure to provide timely or accurate reports is justification for cancellation of the contract and/or justification for removal from consideration for award of contracts by the State.

7. COST/PRICE ADJUSTMENTS

7.1 Cost Increase by Mutual Agreement. After the initial term of the contract, each renewal term may be subject to a cost increase by mutual agreement. Contractor must provide written, verifiable justification for any cost adjustments they request during each renewal period. Contractor shall provide its cost adjustments in both written and electronic format.

7.2 Differing Site Conditions. If, during the term of this contract, circumstances or conditions are materially different than set out in the specifications, the Contractor may be entitled to an equitable adjustment in the contract price. The Contractor shall immediately cease work and notify, in writing, the State of any such conditions necessitating an adjustment as soon as they are suspected and prior to the changed conditions affecting the performance of this contract. Any adjustment shall be agreed upon in writing by both parties to the contract.

7.3 Cost/Price Adjustment. All requests for cost/price adjustment must be submitted between April 1st and April 30th along with written justification. Requests received after April 30th will not be considered unless written approval from the SPB Contracts Officer is given to submit at a later date. In no event will cost/price adjustments be allowed beyond May 15th. All requests that are approved will be incorporated by contract amendment and made effective July 1st of the next approved renewal period.

8. SERVICES AND/OR SUPPLIES

8.1 Service Categories. Contractor agrees to provide to the State the following services:

Water Quality Monitoring – Fixed Station and Probabilistic Design. The statewide monitoring network has three components. The first component is the fixed station water quality-monitoring network. There are 38 fixed station sites located on streams throughout Montana where there are active USGS gauging stations. The USGS is currently contracted to collect all of the water chemistry samples. The State may also collect sediment samples for trace metal analyses. Remote sensing may be used to assess stream geomorphology, flood plain and watershed characteristics.

Water Quality Monitoring - Lakes and Streams. As part of the monitoring program, standards criteria and TMDL development, lakes will continue to be sampled collecting chemistry, physical, and habitat parameters. Stream sampling may include sediment and water chemistry, geomorphology, habitat, or sources of pollutants (e.g., pebble counts, channel cross-section, stream reach assessments, photo points, Rosgen Type II, etc GIS and remote sensing may be used to assess riparian habitats, and watershed physical characteristics.

Water Quality Monitoring - Reference Sites. As part of the monitoring program and standards criteria development, reference sites will continue to be identified and characterized as described in 3.5.2.

TMDL Targets. The TMDL program (within DEQ) will often need additional data in order to develop TMDL targets. Targets are quantitative water quality goals or “endpoints” that represent all the applicable

narrative or numeric water quality standards. These targets, when achieved will represent full beneficial use support. This may require additional monitoring to determine reference condition when TMDL targets are based on narrative criteria or designated uses (water quality standards). Targets may be based on numeric water quality criteria, pollutant concentrations or loads, habitat or geomorphic measures, and/or biological criteria or populations. Targets are also used to determine the existing Water Quality Impairment Status (WQIS) of the streams on the 303(d) list. In most cases, the contractor will be required to write a report, which includes a recommendation and justification for one or more TMDL targets and also compare those targets to the existing conditions to determine WQIS. Communication with the State is crucial while deriving preliminary targets to ensure TMDL consistency across Montana. For consideration in this service area, the contractor should also have experience and be accepted for service categories 3.5.4 and 3.5.12-15.

TMDL Source Assessment/Delineation. The TMDL program (within DEQ) will often need additional data in order to link water quality impairments to their sources, or to allocate sources of pollutants. This may require data compilation, investigative monitoring and statistical analysis within a specified watershed, which can be used for source allocation, or the linkage of water quality impairments to causes and sources of impairment (e.g., sediment or land use practices). Quantitative source assessments may be conducted using field-based monitoring and/or interpretation and analysis of aerial photos, digital images, or GIS coverages depending upon impairment sources and available information. In most cases, contractors will be required to write a report that identifies what the major causes of impairment are and where the major sources of pollutants are located. DEQ will also need to have all pollution/pollutant sources quantified. The quantification of these loads will assist in both source load allocations and the total maximum daily loads. In addition, data collected during source assessments must be entered into an approved database structure or format and linkage to the National Hydrography Dataset (NHD) streams layer may be requested. The department may also request a cost/benefit analysis for implementing BMPs, which can be used for developing TMDL source allocations. Communication with the State is crucial while deriving assessing sources of pollutants to ensure TMDL consistency across Montana. For consideration in this service area, the contractor should also have experience and be accepted for service categories 3.5.4, 3.5.6, and 3.5.12-15.

TMDL Load Allocations. The TMDL program (within DEQ) will often need additional data in order to develop load allocations in conjunction with the source assessment/delineation. Load allocations are the portion of a receiving water's loading capacity that is attributed to existing or future point or non-point sources of pollution or to natural background sources. Load allocations are best estimates of the loading, which can range from reasonably accurate estimates to gross allotments. Allocation can be expressed as a percent reduction that results in a maximum allowable load or as performance-based, which demonstrates how BMPs will be applied and how they will reduce the current loads. Communication with the State is crucial while deriving preliminary load allocations to ensure TMDL consistency across Montana. For consideration in this service area, the contractor should also have experience and be accepted for service categories 3.5.4, 3.5.6-7, and 3.5.12-15.

Total Maximum Daily Loads. The TMDL program (within DEQ) will often need additional data in order to develop Total Maximum Daily Loads (TMDLs). A TMDL is defined as the sum of the wasteload allocations to point sources, load allocations to non-point sources and natural background sources with a margin of safety considering seasonal variation. TMDLS can be expresses in terms of mass per time, toxicity, or other appropriate measures that relate to the State's Water Quality Standards. Communication with the State is crucial while deriving preliminary TMDLs to ensure consistency across Montana. For consideration in this service area, the contractor should also have experience and be accepted for service categories 3.5.4, 3.5.6-8, and 3.5.12-15.

Stakeholder Participation. The TMDL program (within DEQ) will often need additional assistance in order to develop implementation/restoration strategies and monitoring plans. These plans often require public involvement with the local stakeholders. These efforts typically results in developing the measures needed to achieve full beneficial use support or to monitoring the uncertainties that arise during the TMDL process. Offerors should be experienced in or have staff members with proper credentials to facilitate participation with local stakeholders.

TMDL Effectiveness Monitoring. Effectiveness monitoring will be required to evaluate the success of implementing a TMDL plan. Monitoring will often include the collection of some combination of chemical,

physical or biological data, which can be used to determine if water quality is improving over time. Most monitoring designs and techniques will be fairly straightforward and may only require visiting a site once per year. In most cases, the contractor will be required to write an annual report, which can be used to determine if water quality is improving.

Remote Sensing. The State may consider the use of remote sensing for characterizing a watershed and identifying probable sources of pollutants. For example, indicator metrics may be calculated from an air photo. Metrics may include active channel width, Rosgen level 1 Channel types, % shade, % land use, % land cover, average flood plain width, riparian corridor fragmentation, road density, road crossings, length of irrigation ditch/area, etc. DEQ may request contractors to assist them in developing remote sensing assessment techniques or to employ developed techniques in conducting detailed assessments. All data must be entered into an approved database structure, format, or program and linkage to the National Hydrography Dataset (NHD) streams layer may be requested. If necessary, the Contractor can subcontract in order to acquire the aerial photography products. All subcontractors for this task must be approved by the State prior to initiating a contract.

Statistical Analysis. The State may request that large data sets be statistically analyzed for determining trends or for making comparisons. This service area may include data compilation, organization, manipulation and analysis. These analyses may be used to validate environmental targets by comparing reference data to existing data. They may also be used to establish a relationship or linkage between indicators and targets, the estimated loads and how targets link to beneficial use support. Analyses should be appropriate for the type of data being analyzed. In many cases, the contractor will be responsible for determining and providing rationale for appropriate statistical analyses to address pre-formulated environmental hypotheses. Analyses must consider spatial and temporal variations. Analyses may range from providing simple descriptive statistics to reporting multifactor predictive analyses.

DEQ Electronic Data / Information Technical Assistance. The DEQ needs to be able to easily transmit water quality data into the modernized STORET database and make it more accessible to data consumers and the public. To accomplish this, the DEQ seeks to obtain technical products, services, and support, as needed, to migrate datasets to production database system(s) and improve data flow and data quality from a variety of sources into STORET. These tasks may include, but are not limited to solutions in commonly available software products to generate data that conforms to STORET and Oracle database requirements. Specific service areas sought include, but are not limited to: technical support for data conversion, reformatting, and/or normalization of existing historic and transformed datasets; automated data validation routines or procedures designed to support specific data quality objectives; technical solutions for data entry, data capture, and data reporting, maintenance, upgrades or enhancements to existing software interfaces; technical support in the implementation of STORET; acquisition of STORET-compatible data deliverables.

Revegetation Services. Revegetation Specialists are utilized by the State and other governmental entities to enhance and complete environmental project tasks. The services offered by Revegetation Specialists are planning, designing, implementation along with providing of supplies, materials and equipment necessary to carryout the tasks. If a firm does not have the staff or equipment to implant a project, they must then be able to demonstrate a plan for delivery of product and implementation of a project through subcontracting or professional cooperative agreements.

Communication/Education Services – Information Transfer & TMDL Technical Editing. Communication/education contractor specializing in information transfer would assist in the design, production and distribution of information for target audiences via TV, radio, or print media. These projects often require the conversion of complex water quality data into information the public can understand. Products include pamphlets, brochures, guidebooks, and videos; maintaining a webpage, writing press releases; set up public meetings, give interviews, make presentations at workshops and conferences and organize conferences and set up field trips. Offerors in this field may also specify their ability to provide Technical Editing of Natural Science documents, in particular Total Maximum Daily Load documents. Technical editing can include, but is not limited to proofreading for grammar and mathematical errors, document clarity, and linkage between different sections.

Preparation of Technical Manuals or Circulars. Regulatory programs require periodic preparation of technical materials to guide either public regulated entities or in-house staff in how to work through a regulatory requirement such as obtaining or writing a permit. These products require technical writing, document preparation, preparation of figures or tables, preparation and use of spreadsheets, research and assimilation of regulations, technical approaches to problem solving and explanation of approaches to prepare applications and/or actual permits.

8.2 Reuse of Documents. When the projects dictate a design or engineered approach, the State agrees that it will not apply the Contractor's designs to any other projects.

9. ENGINEERING ACCESS

All of the firms selected may need to have access to engineering services depending on the nature of the project. The contractor(s) will be expected to use their own best judgment as to whether engineering services are needed for a given project. However, traditional engineering methodologies are not the emphasis of this RFP. It is a violation of State Statute to practice engineering or land surveying without a license.

10. PROJECT SELECTION

10.1 Project Identification. The State will be responsible for identifying projects, contacting landowners and securing necessary permission/cooperation agreements, selecting a contractor, writing grant applications and approving project payments.

10.2 Hazardous Materials. The State will not initiate projects where it is known that hazardous materials are present. If there is an indication of a potential of hazardous materials, then the State will do testing prior to contacting the contractor. However, there is always the possibility of unforeseen problems resulting in the stoppage of a project.

10.3 Meetings. The selected contractor may be required to meet with State personnel at the project site to conduct a site evaluation, discuss project issues and begin the negotiation process on project feasibility, conceptual design and costs for each project.

10.4 Approach Expectations. In the case of restoration activities, the agency will identify the preferred techniques. The determination made by the State may define which contractor(s) are contacted for project initiation. The State is always open to new and innovative approaches that accomplish project goals.

11. SELECTING A CONTRACTOR

The State may select a term contract holder from the Environmental Services contract home page as provided under the state's website address http://www.discoveringmontana.com/doa/gsd/procurement/TermContracts/environservices/Default.asp, taking into consideration such things as the contractor's area of expertise, requirements and location of the project, the contractor's availability and access to resources necessary to efficiently and effectively complete the project, demonstrated excellent past performance on State and public projects, identified subcontractors and total project cost.

General. Ordering agencies shall use the procedures in this section when ordering services priced at hourly rates as established by each Term Contract (TC). The applicable service categories are identified in each TC along with the contractor's price lists.

Request for Quotation (RFQ) procedures. The ordering agency must provide an RFQ, which includes the statement of work and limited, but specific evaluation criteria (*e.g.*, experience and past performance), to TC contractors that offer services that will meet the agency's needs. The RFQ may be posted to the agency's state website to expedite responses.

Statement of Work (SOWs). All SOW's shall include at a minimum a detailed description of the work to be performed, location of work, period of performance, deliverable schedule, applicable performance standards and any special requirements (e.g., security clearances, travel, special knowledge).

(1) Ordering agency may select a contractor from the appropriate service category and directly negotiate a mutually acceptable project based on a sudden and unexpected happening or unforeseen occurrence or condition, which requires immediate action. (Exigency).

(2) Ordering agency may place orders at or below the $5,000 threshold with any TC contractor that can meet the agency's needs. The ordering agency should attempt to distribute orders among all service category contractors.

(3) For orders estimated to exceed $5,000 but less than $25,000.

(i) The ordering agency shall develop a statement of work.
(ii) The ordering agency shall provide the RFQ (including the statement of work and evaluation criteria) to at least three TC contractors that offer services that will meet the agency's needs.
(iii) The ordering agency shall request that contractors submit firm-fixed prices to perform the services identified in the statement of work.

(4) For orders estimated to exceed $25,000. In addition to meeting the requirements of (3) above, the ordering agency shall:

(i) Provide the RFQ (including the statement of work and the evaluation criteria) to a minimum of six service category TC contractors (if category has less than 6, all contractors will be offered an RFQ) with a 50% replacement factor for each subsequent request for quote in the same service category.

Evaluation. The ordering agency shall evaluate all responses received using the evaluation criteria provided in the RFQ to each TC contractor. The ordering agency is responsible for considering the level of effort and the mix of labor proposed to perform a specific task being ordered, and for determining that the total price is reasonable. The agency will place the order with the contractor that represents the best value. After award, ordering agencies will provide timely notification to unsuccessful TC contractors. If an unsuccessful TC contractor requests information on a task order award that was based on factors other than price alone, a brief explanation of the basis for the award decision shall be provided.

Minimum documentation. The ordering agency shall document:
(1) The TC contractors considered, noting the contractor from which the service was purchased.
(2) A description of the service purchased.
(3) The amount paid.
(4) The evaluation methodology used in selecting the contractor to receive the order.
(5) The rationale for making the selection.
(6) Determination of price fair and reasonableness.

Agency project task orders will be utilized to finalize the project. Only written addenda will be used for adjustments of the task orders and must be signed by both parties. All task orders must contain signatures from both parties and appropriate agency legal review as directed in their procurement policy.

The State will monitor contractor selection by using the information provided in the annual TC usage reports.

Contractor's who fail to respond to three RFQ opportunities within a one-year period between July 1st and June 30th may be removed from the qualified list of contractors.

12. CONTRACTOR RESPONSIBILITIES

12.1 Supervision and Implementation. The selected contractor for an individual project will be responsible for the supervision and implementation of the approach and will be responsible for oversight of work performed by all subcontractors. In most cases the contractor will provide and be responsible for all the

necessary equipment, materials, supplies and personnel necessary for proper execution of the work. However, the State reserves the right to hire subcontractors (equipment and/or labor) if it will provide a cost savings to the State. The selected contractor will also be responsible for clean up of the sites if necessary and must have the sites inspected by the State immediately prior to completion.

12.2 On-Site Requirements. When a contractor is contacted by the State to discuss a project, the State and the contractor may visit the job site if deemed necessary by the Project Manager, to become familiar with conditions relating to the project and the labor requirements. The State will provide a detailed scope of work for the project and request the contractor supply the State with a response to project approach, cost, timeframe and any other information deemed necessary by the State to make a selection or complete a contract negotiation.

In the cases of Restoration or On-The-Ground Activities, the contractor shall adequately protect the work, adjacent property, and the public in all phases of the work. They shall be responsible for all damages or injury due to their action or neglect.

The contractor shall maintain access to all phases of the contract pending inspection by the State, the landowner, or their representative. All interim or final products funded by the contract will become the property of the State or Cooperative Purchaser upon payment for said products.

All work rejected as unsatisfactory shall be corrected prior to final inspection and acceptance. The contractor shall respond within seven calendar days after notice of observed defects has been given and shall proceed to immediately remedy these defects. Should the contractor fail to respond to the notice or not remedy the defects, the State may have the work corrected at the expense of the contractor.

12.3 Clean Up (when project tasks require). The contractor shall:

- Keep the premises free from debris and accumulation of waste;
- Clean up any oil or fuel spills;
- Keep machinery clean and free of weeds;
- Remove all construction equipment, tools and excess materials; and
- Perform finishing site preparation to limit the spread of noxious weeds before final payment by the State.

12.4 Applicable Laws. The contractor shall keep informed of, and shall comply with all applicable laws, ordinances, rules, regulations and orders of the City, County, State, Federal or public bodies having jurisdiction affecting any work to be done to provide the services required. The contractor shall provide all necessary safeguards for safety and protection, as set forth by the United States Department of Labor, Occupational Safety and Health Administration.

12.5 Cooperation. The contractor shall work closely with the States analytical consultants, (i.e. environmental laboratories and taxonomists) to develop the desired products.

12.6 Work Acceptance. The contractor is responsible for project oversight as needed. The State may also periodically provide personnel for administrative oversight from the initiation of the contract through project completion. All work will be inspected by the State or designated liaison prior to approval of any contract payments. All work rejected as unsatisfactory shall be corrected prior to final inspection and acceptance. Contractor shall respond within seven calendar days after notice of defects has been given by the State and proceed to immediately remedy all defects.

12.7 Records. The contractor will supply the State with documentation, when requested, of methods used throughout project implementation. Contractor will maintain records for themselves and all subcontractors of supplies, materials, equipment and labor hours expended.

12.8 Communication. Remoteness of project sites may necessitate that the contractor have some form of field communication such as a cellular phone. This communication is necessary to enable the State to respond to public concerns related to the project, accidents, inspections, or other project issues that require immediate feedback. In addition, the State or Cooperative Purchaser may require scheduled communication at

agreed upon intervals. The communication schedule will be dependent upon the project circumstances and requirements of the contracting agency. In the case when a communication schedule is included in the Scope of Work, the schedule will commence when the contractor initiates the project.

12.9 Change Of Staffing. Since qualifications of personnel were key in determining which offerors were selected to be on this TC, a written notification of any changes in key personnel must be made to the state agency, prior to entering into negotiations to perform any specific work scope. Contractor shall replace such employee(s) at its own expense with an employee of substantially equal abilities and qualifications without additional cost to the agency. If these staffing changes cause the contractor to no longer meet the qualifications stated herein, that firm will be removed from the service area of this TC. Failure to notify the state agency of staffing changes could result in the contractor being removed from the TC listing and possible suspension from bidding on other state projects.

12.10 Collaboration. The State encourages collaboration between contractors to increase the scope of services offered. In cases where the chosen contractor is not able to provide all services needed for the project, the State will expect the chosen contractor to contact other contractors on this list to negotiate subcontracts for these services before going elsewhere. Exceptions to this strategy will be evaluated on a case-by-case basis.

12.11 Subcontractors, Project Budget and Invoicing. All subcontractors to be used in any project must be approved by the authorized entity initiating the project. Project budgets will be negotiated for each individual project contract. However, all rates, terms and conditions set forth in this term contract will be applied to individual contracts. Subcontractor is defined as anyone other than the prime contractor having substantial direct involvement in a specific project.

The State reserves the right to choose the invoicing method from the following:

- Prime contractor's billing will include the subcontractors charges and payment will be made to the prime, or
- Prime and subcontractors will bill the State separately and the State will pay each directly.

13. CONSIDERATION/PAYMENT

13.1 Payment Schedule. In consideration for the services to be provided, the State shall pay according to the negotiated agreement for each project. Hourly rates and miscellaneous charges as provided in Attachment B shall apply.

13.2 Withholding of Payment. The State may withhold payments to the Contractor if the Contractor has not performed in accordance with this contract. Such withholding cannot be greater than the additional costs to the State caused by the lack of performance.

14. CONTRACTOR REGISTRATION

The Contractor will be registered with the Department of Labor and Industry under sections 39-9-201 and 39-9-204, MCA, *prior* to contract execution. The State cannot execute a contract for construction to a Contractor who is not registered. (Mont. Code Ann. § 39-9-401.)

ADC Services, Inc. Contractor Registration Number: 51779

15. CONTRACTOR WITHHOLDING

Section 15-50-206, MCA, requires the state agency or department for whom a public works construction contract over $5,000 is being performed, to withhold 1 percent of all payments and to transmit such monies to the Department of Revenue.

16. MONTANA PREVAILING WAGE REQUIREMENTS

Unless superseded by federal law, Montana law requires that contractors and subcontractors give preference to the employment of Montana residents for any public works contract in excess of $25,000 for construction or nonconstruction services in accordance with sections 18-2-401 through 18-2-432, MCA, and all administrative rules adopted pursuant thereto. Unless superseded by federal law, at least 50% of the workers of each contractor engaged in construction services must be performed by bona fide Montana residents. The Commissioner of the Montana Department of Labor and Industry has established the resident requirements in accordance with sections 18-2-403 and 18-2-409, MCA. Any and all questions concerning prevailing wage and Montana resident issues should be directed to the Montana Department of Labor and Industry.

In addition, unless superseded by federal law, all employees working on a public works contract shall be paid prevailing wage rates in accordance with sections 18-2-401 through 18-2-432, MCA, and all administrative rules adopted pursuant thereto. Montana law requires that all public works contracts, as defined in section 18-2-401, MCA, in which the total cost of the contract is in excess of $25,000, contain a provision stating for each job classification the standard prevailing wage rate, including fringe benefits, travel, per diem, and zone pay that the contractors, subcontractors, and employers shall pay during the public works contract.

Furthermore, section 18-2-406, MCA, requires that all contractors, subcontractors, and employers who are performing work or providing services under a public works contract post in a prominent and accessible site on the project staging area or work area, no later than the first day of work and continuing for the entire duration of the contract, a legible statement of all wages and fringe benefits to be paid to the employees in compliance with section 18-2-423, MCA. Section 18-2-423, MCA, requires that employees receiving an hourly wage must be paid on a weekly basis.

Each contractor, subcontractor, and employer must maintain payroll records in a manner readily capable of being certified for submission under section 18-2-423, MCA, for not less than three years after the contractor's, subcontractor's, or employer's completion of work on the public works contract.

The nature of the work performed or services provided under this contract meets the statutory definition of a "public works contract" under section 18-2-401(11)(a), MCA, and falls under the category of Heavy Construction and Nonconstruction services. The booklets containing Montana's 2003 Rates for Nonconstruction Services **and 2004 Rates for Heavy Construction** are attached.

The most current Montana Prevailing Wage Booklet will automatically be incorporated at time of renewal. It is the contractor's responsibility to ensure they are using the most current prevailing wages during performance of its covered work.

17. ACCESS AND RETENTION OF RECORDS

17.1 Access to Records. The Contractor agrees to provide the State, Legislative Auditor or their authorized agents access to any records necessary to determine contract compliance. (Mont. Code Ann. § 18-1-118.)

17.2 Retention Period. The Contractor agrees to create and retain records supporting the environmental services for a period of three years after either the completion date of this contract or the conclusion of any claim, litigation or exception relating to this contract taken by the State of Montana or a third party.

18. ASSIGNMENT, TRANSFER AND SUBCONTRACTING

The Contractor shall not assign, transfer or subcontract any portion of this contract without the express written consent of the State. (Mont. Code Ann. § 18-4-141.) The Contractor shall be responsible to the State for the acts and omissions of all subcontractors or agents and of persons directly or indirectly employed by such subcontractors, and for the acts and omissions of persons employed directly by the Contractor. No contractual relationships exist between any subcontractor and the State.

19. HOLD HARMLESS/INDEMNIFICATION

The Contractor agrees to protect, defend, and save the State, its elected and appointed officials, agents, and employees, while acting within the scope of their duties as such, harmless from and against all claims, demands, causes of action of any kind or character, including the cost of defense thereof, arising in favor of the Contractor's employees or third parties on account of bodily or personal injuries, death, or damage to property arising out of services performed or omissions of services or in any way resulting from the acts or omissions of the Contractor and/or its agents, employees, representatives, assigns, subcontractors, except the sole negligence of the State, under this agreement.

20. REQUIRED INSURANCE

20.1 General Requirements. The Contractor shall maintain for the duration of the contract, at its cost and expense, insurance against claims for injuries to persons or damages to property, including contractual liability, which may arise from or in connection with the performance of the work by the Contractor, agents, employees, representatives, assigns, or subcontractors. This insurance shall cover such claims as may be caused by any negligent act or omission.

20.2 Primary Insurance. The Contractor's insurance coverage shall be primary insurance as respect to the State, its officers, officials, employees, and volunteers and shall apply separately to each project or location. Any insurance or self-insurance maintained by the State, its officers, officials, employees or volunteers shall be excess of the Contractor's insurance and shall not contribute with it.

20.3 Specific Requirements for Commercial General Liability. The Contractor shall purchase and maintain occurrence coverage with combined single limits for bodily injury, personal injury, and property damage of $1,000,000 per occurrence and $2,000,000 aggregate per year to cover such claims as may be caused by any act, omission, or negligence of the Contractor or its officers, agents, representatives, assigns or subcontractors.

20.4 Additional Insured Status. The State, its officers, officials, employees, and volunteers are to be covered and listed as additional insureds; for liability arising out of activities performed by or on behalf of the Contractor, including the insured's general supervision of the Contractor; products and completed operations; premises owned, leased, occupied, or used.

20.5 Specific Requirements for Automobile Liability. The Contractor shall purchase and maintain coverage with split limits of $500,000 per person (personal injury), $1,000,000 per accident occurrence (personal injury), and $100,000 per accident occurrence (property damage), OR combined single limits of $1,000,000 per occurrence to cover such claims as may be caused by any act, omission, or negligence of the contractor or its officers, agents, representatives, assigns or subcontractors.

20.6 Additional Insured Status. The State, its officers, officials, employees, and volunteers are to be covered and listed as additional insureds for automobiles leased, hired, or borrowed by the Contractor.

20.7 Specific Requirements for Professional Liability. The Contractor shall purchase and maintain occurrence coverage with combined single limits for each wrongful act of $1,000,000 per occurrence and $2,000,000 aggregate per year to cover such claims as may be caused by any act, omission, negligence of the Contractor or its officers, agents, representatives, assigns or subcontractors. Note: if "occurrence" coverage is unavailable or cost prohibitive, the Contractor may provide "claims made" coverage provided the following conditions are met: (1) the commencement date of the contract must not fall outside the effective date of insurance coverage and it will be the retroactive date for insurance coverage in future years; and (2) the claims made policy must have a three year tail for claims that are made (filed) after the cancellation or expiration date of the policy.

20.8 Deductibles and Self-Insured Retentions. Any deductible or self-insured retention must be declared to and approved by the state agency. At the request of the agency either: (1) the insurer shall reduce or eliminate such deductibles or self-insured retentions as respects the State, its officers, officials, employees,

or volunteers; or (2) at the expense of the Contractor, the Contractor shall procure a bond guaranteeing payment of losses and related investigations, claims administration, and defense expenses.

20.9 Certificate of Insurance/Endorsements. A certificate of insurance from an insurer with a Best's rating of no less than A- indicating compliance with the required coverages, has been received by the State Procurement Bureau, PO Box 200135, Helena MT 59620-0135. The Contractor must notify the State immediately, of any material change in insurance coverage, such as changes in limits, coverages, change in status of policy, etc. The State reserves the right to require complete copies of insurance policies at all times.

21. COMPLIANCE WITH THE WORKERS' COMPENSATION ACT

Contractors are required to comply with the provisions of the Montana Workers' Compensation Act while performing work for the State of Montana in accordance with sections 39-71-120, 39-71-401, and 39-71-405, MCA. Proof of compliance must be in the form of workers' compensation insurance, an independent contractor's exemption, or documentation of corporate officer status. Neither the contractor nor its employees are employees of the State. This insurance/exemption must be valid for the entire term of the contract. A renewal document must be sent to the State Procurement Bureau, PO Box 200135, Helena MT 59620-0135, upon expiration.

22. COMPLIANCE WITH LAWS

The Contractor must, in performance of work under this contract, fully comply with all applicable federal, state, or local laws, rules and regulations, including the Montana Human Rights Act, the Civil Rights Act of 1964, the Age Discrimination Act of 1975, the Americans with Disabilities Act of 1990, and Section 504 of the Rehabilitation Act of 1973. Any subletting or subcontracting by the Contractor subjects subcontractors to the same provision. In accordance with section 49-3-207, MCA, the Contractor agrees that the hiring of persons to perform the contract will be made on the basis of merit and qualifications and there will be no discrimination based upon race, color, religion, creed, political ideas, sex, age, marital status, physical or mental disability, or national origin by the persons performing the contract.

23. INTELLECTUAL PROPERTY

All patent and other legal rights in or to inventions created in whole or in part under this contract must be available to the State for royalty-free and nonexclusive licensing. Both parties shall have a royalty-free, nonexclusive, and irrevocable right to reproduce, publish or otherwise use and authorize others to use, copyrightable property created under this contract.

24. PATENT AND COPYRIGHT PROTECTION

24.1 Third Party Claim. In the event of any claim by any third party against the State that the products furnished under this contract infringe upon or violate any patent or copyright, the State shall promptly notify Contractor. Contractor shall defend such claim, in the State's name or its own name, as appropriate, but at Contractor's expense. Contractor will indemnify the State against all costs, damages and attorney's fees that accrue as a result of such claim. If the State reasonably concludes that its interests are not being properly protected, or if principles of governmental or public law are involved, it may enter any action.

24.2 Product Subject of Claim. If any product furnished is likely to or does become the subject of a claim of infringement of a patent or copyright, then Contractor may, at its option, procure for the State the right to continue using the alleged infringing product, or modify the product so that it becomes non-infringing. If none of the above options can be accomplished, or if the use of such product by the State shall be prevented by injunction, the State will determine if the Contract has been breached.

25. CONTRACT TERMINATION

25.1 Termination for Cause. The State may, by written notice to the Contractor, terminate this contract in whole or in part at any time the Contractor fails to perform this contract.

25.2 Reduction of Funding. The State, at its sole discretion, may terminate or reduce the scope of this contract if available funding is reduced for any reason. (See Mont. Code Ann. § 18-4-313(3).)

26. STATE PERSONNEL

26.1 State Contract Manager. The State Contract Manager identified below is the State's single point of contact and will perform all contract management pursuant to section 2-17-512, MCA, on behalf of the State. Written notices, requests, complaints or any other issues regarding the contract should be directed to the State Contract Manager.

The State Contract Manager for this contract is:

Robert Oliver, Contracts Officer
Room 165 Mitchell Building
125 North Roberts
PO Box 200135
Helena MT 59620-0135
Telephone #: (406) 444-0110
Fax #: (406) 444-2529
E-mail: roliver@mt.gov

26.2 State Project Manager. Each using State agency or Cooperative Purchaser will identify a Project Manager in the project task order. The Project Manager will manage the day-to-day project activities on behalf of the State/Cooperative Purchaser.

27. CONTRACTOR PERSONNEL

27.1 Change Of Staffing. Since qualifications of personnel was key in determining which offerors were selected to be on this term contract list, a written notification to the State Procurement Bureau of any changes of key personnel must be made within two weeks of the change. These change notifications will be completed upon the departure or hiring of key personnel who are professional employees critical to awarded service areas. If these staffing changes cause the firm to no longer meet the qualifications stated herein, that firm will be removed from the service area of this term contract. Failure to notify the State Procurement Bureau of staffing changes could result in the contractor being removed from the term contract listing and possible suspension from bidding on other State projects.

27.2 Contractor Contract Manager. The Contractor Contract Manager identified below will be the single point of contact to the State Contract Manager and will assume responsibility for the coordination of all contract issues under this contract. The Contractor Contract Manager will meet with the State Contract Manager and/or others necessary to resolve any conflicts, disagreements, or other contract issues.

The Contractor Contract Manager for this contract is:

Jeff Leety
PO Box 1384
482 Electric Ave Suite 5
Bigfork MT 59911
Telephone #: (406) 837-0804
Fax #: (406) 837-0842
E-mail: jeff@oasisenviro.com

27.3 Contractor Project Manager. The Contractor Project Manager identified below will manage the day-to-day project activities on behalf of the Contractor:

The Contractor Project Manager for this contract is:

Jeff Leety
John Gangemi
Nathan Sande
PO Box 1384
482 Electric Ave Suite 5
Bigfork MT 59911
Telephone #: (406) 837-0804
Fax #: (406) 837-0842
E-mail: jeff@oasisenviro.com
johng@oasisenviro.com
Nathan@oasisenviro.com

28. MEETINGS

The Contractor is required to meet with the State's personnel, or designated representatives, to resolve technical or contractual problems that may occur during the term of the contract or to discuss the progress made by Contractor and the State in the performance of their respective obligations, at no additional cost to the State. Meetings will occur as problems arise and will be coordinated by the State. The Contractor will be given a minimum of three full working days notice of meeting date, time, and location. Face-to-face meetings are desired. However, at the Contractor's option and expense, a conference call meeting may be substituted. Consistent failure to participate in problem resolution meetings two consecutive missed or rescheduled meetings, or to make a good faith effort to resolve problems, may result in termination of the contract.

29. CONTRACTOR PERFORMANCE ASSESSMENTS

The State may do assessments of the Contractor's performance. This contract may be terminated for one or more poor performance assessments. Contractors will have the opportunity to respond to poor performance assessments. The State will make any final decision to terminate this contract based on the assessment and any related information, the Contractor's response and the severity of any negative performance assessment. The Contractor will be notified with a justification of contract termination. Performance assessments may be considered in future solicitations.

30. TRANSITION ASSISTANCE

If this contract is not renewed at the end of this term, or is terminated prior to the completion of a project, or if the work on a project is terminated, for any reason, the Contractor must provide for a reasonable period of time after the expiration or termination of this project or contract, all reasonable transition assistance requested by the State, to allow for the expired or terminated portion of the services to continue without interruption or adverse effect, and to facilitate the orderly transfer of such services to the State or its designees. Such transition assistance will be deemed by the parties to be governed by the terms and conditions of this contract, except for those terms or conditions that do not reasonably apply to such transition assistance. The State shall pay the Contractor for any resources utilized in performing such transition assistance at the most current rates provided by the contract. If there are no established contract rates, then the rate shall be mutually agreed upon. If the State terminates a project or this contract for cause, then the State will be entitled to offset the cost of paying the Contractor for the additional resources the Contractor utilized in providing transition assistance with any damages the State may have otherwise accrued as a result of said termination.

31. CHOICE OF LAW AND VENUE

This contract is governed by the laws of Montana. The parties agree that any litigation concerning this bid, proposal or subsequent contract must be brought in the First Judicial District in and for the County of Lewis and Clark, State of Montana and each party shall pay its own costs and attorney fees. (See Mont. Code Ann. § 18-1-401.)

32. SCOPE, AMENDMENT AND INTERPRETATION

32.1 Contract. This contract consists of 12 numbered pages, any Attachments as required, RFP # SPB05-894P**,** as amended and the Contractor's RFP response as amended. In the case of dispute or ambiguity about the minimum levels of performance by the Contractor the order of precedence of document interpretation is in the same order.

32.2 Entire Agreement. These documents contain the entire agreement of the parties. Any enlargement, alteration or modification requires a written amendment signed by both parties.

33. EXECUTION

The parties through their authorized agents have executed this contract on the dates set out below.

DEPARTMENT OF ADMINISTRATION
STATE PROCUREMENT BUREAU
PO BOX 200135
HELENA MT 59620-0135

BY:_____
Penny Moon, Contracts Officer

BY:_____
(Signature)

DATE:_____

OASIS ENVIRONMENTAL
482 ELECTRIC AVE SUITE 5
BIGFORK MT 59911
FEDERAL ID # 92-0155937

BY:_____
(Name/Title)

BY:_____
(Signature)

DATE:_____

ATTACHMENT A
CONTRACTOR'S RESPONSE

Offeror Informational Requirements – All Service Categories

This proposal is submitted by OASIS Environmental, Inc. (OASIS) in response to the State of Montana's Environmental Services Request for Proposal SPB05-894P, and is submitting under the annual term contract listing addition for 2005, as described in Section 1.1 of the RFP. OASIS understands that the State of Montana wishes to secure the services of qualified firms to provide a variety of environmental services throughout Montana for state agencies and other public procurement units. We have carefully reviewed the RFP and have prepared this proposal following the outline and instructions contained therein.

OASIS Environmental, Inc. has completed the following informational requirements sections so that each category may be evaluated without cross-references to information provided for other service categories. OASIS recognizes that separating and providing information in its entirety for each category will ease the State's evaluation process, allowing each respective service category evaluation team to gather all required information without having to reference text listed within other sections of this proposal. Text included in the company profile and experience section (Section 0) is the only text that will not be repeated and cross-referenced back to its original location. Only specifics regarding methods of providing services and quality assurance will be entered for each service category. The general OASIS project approach to providing services and quality assurance is specified in Section 0, and will not be repeated for each service category.

References

Five (5) projects and references are provided for each service category for which OASIS is submitting qualifications for. References pertaining to a particular category may be reviewed within the service category response section. The projects and references provided are intended to be representative projects from the professional staff proposed for each category. Key OASIS personnel are identified for each project and reference.

Company Profile and Experience

OASIS Environmental, Inc (OASIS) is an environmental consulting and engineering company incorporated in 1995. We have a staff of over 40 professionals located in several western United States offices, including offices in Montana, Alaska, Washington, Colorado, and Nevada. Corporation shareholders are comprised of Principal-level staff; thereby, facilitating efficient decision making and responsive management of the company. Profits are shared with all staff annually. Our profit sharing philosophy and an industry leading benefits package together cultivate an exceptionally motivated and committed work force.

Since incorporation, one of our core businesses has been Permitting and Biological Services. Under this core service heading, OASIS employs scientists and engineers who are experts at delineating wetlands, studying watersheds, mitigating lost or damaged habitat, monitoring water quality in lakes and streams, performing biota sampling and successfully interacting with communities and stakeholders. Environmental assessment and remediation services, health, safety and environmental (HSE) management system development and implementation, and information management technologies round out our core service offerings today, with a balance of state, federal, and private industry customers.

OASIS believes in the investment of individuals and their ideas. We feel a multi-disciplinary team comprised of individual professional experience largely dictates the level of capability a team brings to a project. The team we have proposed to service the categories outlined by this RFP ranges from fluvial geomorphology and riparian ecology experts, project engineers and environmental scientists, to highly experienced data analysts, IT experts, and database programmers. A watershed project that is successful in meeting project objectives typically utilizes all of these disciplines at one level or another, and OASIS is presenting this range of highly qualified personnel for projects targeted by this RFP.

The OASIS corporate culture promotes openness, innovation and initiative. This culture is reinforced through the profit-sharing plan previously mentioned which allows all our employees to benefit from our firm's success. Because of this culture, we have been very successful at recruiting high-quality professionals in a competitive labor market. More importantly, we have been successful at *retaining* these valuable people. Only a few of our regular-status professional employees hired have left our firm since our incorporation in 1995. Retention of

project staff and subsequent continuity of project personnel has been a great strength in OASIS' success over the past decade.

The OASIS Team is technically qualified and capable of cost-effectively providing the services required under this contract. Excellence in HSE performance drives safe and environmentally conscientious decisions in our work. Careful design and planning related to flexible resourcing, project execution, HSE management, cost control, and innovation will be used to measure success and continually improve performance over the life of this contract. Simply stated, "Why the OASIS Team"?

- ✓ **Proven Experience and Technical Depth**. OASIS is a small business with big business qualifications. Recent recipients of EPA's Small Business Administration award (April 2005), our professionals thrive primarily on customer services. We are backed by technical competence and depth, and our passion for successful delivery drives us to listen carefully and seek fit-for-purpose, innovative, and cost effective solutions. We are both proud of, yet modest about, our staff qualifications and relevant project experiences. The OASIS Team offers 15 people in Montana to support this contract, and dozens more in nearby states if project needs arise.
- ✓ **Location, Proximity and "Home Grown" Personnel**. Not only is the OASIS Team comprised of local personnel (several of whom were born and/or raised in Montana); our team is geographically positioned to cost effectively provide service across a large portion of the state. We respect expenses associate with travel and mobilization. Our offices based in Bigfork and Livingston will add value and cost savings to project sites proximal to these locations, such as the TMDL studies planned in the northwest, central, and even the eastern portions of the state. It's worth mentioning we are not only local, we are avid users and stakeholders of Montana's natural resources, from recreation to development. As such, we offer a unique perspective and value to the State of Montana because of our hands on experience and relationships within our communities.
- ✓ **Provide More for Less**. OASIS executes well and has an outstanding performance record. The OASIS team consistently completes projects on time and within budget. Our staff continually looks "outside the box" to identify innovative approaches that result in demonstrated cost savings and schedule reductions for our customers. We offer a competitive pricing structure, and introduce the concept of a "prime subcontracting", whereby we seamlessly offer qualified personnel within different organizations to meet project specific needs. Prime subcontracted services are only marked up 3% to illustrate our commitment to this value added concept. The State of Montana Project Leads can actively select a project team they feel best suits their needs, without the hassle of establishing new contracts or worrying about excessive pass through fees. Our aim is to offer competitive, competent and cost effective "one-stop-shopping".
- ✓ **Systems Capabilities and HSE Performance**. The OASIS Team will implement a well-established definitive set of controls to ensure performance while maintaining a high standard of quality. These controls include our financial management system, our cost- and schedule- tracking systems, and our ISO14001-certified Health, Safety, and Environmental Management System (HSEMS). Our proven systems provide Project Managers and employees with the tools they need to effectively manage projects. The HSEMS extends into successful contract delivery by providing project managers and technical staff with defined procedures for performing work. These operational controls promote standardization for maximum efficiency. Our HSE performance is exemplary and integral to every task we perform. These systems combined with our project specific project execution plans set us apart from our competition.
- ✓ **Information Technology and Knowledge Management Tools**. OASIS specializes in management systems and electronic tools to help manage work flow, compliance, monitoring, and reporting. We are able to design and host databases, and understand the protocols associated with data management so that data are retrievable, useable, and storable. All OASIS offices are equipped with the hardware and software necessary to access electronic bulletin boards and "ftp" sites, including modem and Internet. Offices have internal LANs that are wired for modem transfer of graphics, text, and management systems reporting from outside sources, such as field offices. OASIS hosts Extranet services for its customers, and will make this service available to the State of Montana at no cost. This functionality allows the State of Montana project leads to upload and download documents and information, thus streamlining the report submittal and review process.

OASIS has teamed exclusively with **Aquatic Design and Construction, Inc. (ADC)**, a Livingston, Montana-based engineering, consulting and construction company to provide additional expertise, resource depth, and

expanded geographic capabilities. **ADC** specializes in the restoration of stream and riverine systems, wetlands and their associated uplands, as well as lake and pond habitats since 1998. ADC's team of environmental scientists is specialized in fluvial geomorphology, fisheries biology, soils, groundwater and surface water hydrology and hydraulics, bioengineering, stream ecology, remote sensing, plant identification, and advanced statistical analysis. ADC's analytical and field-based knowledge provide the technical expertise to perform a variety of professional environmental services. The services include wetland delineation, mitigation, assessment, restoration, and creation; baseline biological and fluvial geomorphic investigations; environmental monitoring studies; freshwater fisheries studies; watershed assessment; bio-engineered stream bank stabilization, sediment control and revegetation design and implementation; permitting and NEPA/MEPA compliance; ecological risk assessments; data management and advanced statistical analysis. ADC's location and combination of experience in these disciplines augment OASIS' capability to perform watershed projects across the State of Montana.

The ADC design team utilizes a combination of remotely sensed and field-based data to create innovative aquatic and riverine designs using MicroSurvey© Digital Terrain Modeling, HEC-RAS and meta-modeling for complete, long-term solutions. In addition we have a firm knowledge of the most current bioengineered streambank and shoreline restoration techniques. With over 40 years of combined professional experience, our principals and staff have been trained specifically in fisheries biology, hydrology, hydraulics, Rosgen River Morphology (Levels 1-4) and restoration principles as well as other natural channel design methodologies, and wetland delineation methodologies from the Wetlands Institute and the Army Corps – Regulatory IV-Interagency Wetlands ID and Delineation programs. With all ADC aquatic habitat and river channel reclamation and construction projects, comes Project Management, Quality Control, Safety Protocols, Best Management Practices (BMP's) and Monitoring Programs that identify potential on-site Design/Build opportunities.

OASIS and ADC have completed numerous projects involving watershed assessments, complex watershed modeling, and the design of management programs to address point and nonpoint source impairments. Our proposed project team includes scientists and engineers proficient in all aspects of watershed analysis, water quality monitoring and TMDL support services. Examples of relevant project experience are provided for each service category.

Method of Providing Services & Quality Assurance

The OASIS Team proposes the following general project strategies and quality assurance methods to achieve the primary objectives that are keys to the success of the work targeted by this RFP.

- **Implement state-of-the art communication tools and management systems**. These tools include data driven websites, document control and record management systems, and performance measurement, corrective action, and reporting applications. The OASIS Team will propose a plan herein that will allow realization of the vision of "one-stop shopping" for State of Montana projects.
- **Promote the concept of selective resourcing**, whereby the client agency or watershed group's Project Leads take an active role, as desired, in selecting the most appropriate or experienced personnel to support various projects. This approach allows flexibility in staffing and maximizes the availability and experiences of OASIS and ADC.
- **Provide more for less** by offering innovatively competitive pricing along with project managers experienced with estimating and controlling cost. *Markup on our prime subcontractor (ADC) will be only three percent (3%) to illustrate commitment to the selective resourcing approach described above*.

Keys for any program organization to work effectively are clearly defined lines of communication and authority. Mutual respect, common courtesy and knowledge sharing among team members are also important. OASIS is confident our team will demonstrate these qualities and function effectively because the OASIS principals have business and personal relationships with our prime subcontractor, ADC. To minimize potential for miscommunications, or misunderstandings between team members, OASIS will clearly identify the systems and procedures for managing and delegating work scopes, tracking and controlling costs, and verifying compliance with health, safety, and environment (HSE) guidelines. The management approach is summarized in the following bullets.

- **Establish subcontracts with firms on the team**. OASIS will establish a Master Agreement for Subcontracted Services with our prime subcontractor, ADC, as well as any other subcontractors that

may need to be introduced into projects at a later date. The Terms and Conditions of the State of Montana contract will be incorporated into our subcontractor agreement language.

- **Verify compliance with State of Montana insurance requirements**. OASIS will provide the State of Montana's insurance requirements to each of the subcontractors, and require that each subcontractor provide certificates of insurance. OASIS will review these certificates verify compliance, and provide them to the State of Montana as required.
- **Coordinate with the State of Montana and the subcontractor to define the work scope**. OASIS will coordinate with the Sate of Montana Project Leader and subcontractor to define the personnel, work scope and budget for each project. For instances where the Team Subcontractor may be the Technical Lead, OASIS will encourage direct communication between the customer and teaming subcontractors to the level necessary for project success. Any modifications deemed necessary by the Project Lead and subcontractor Technical Lead will not be developed or modified without direct OASIS participation to maintain project control (scope, budget, and schedule). OASIS will provide this communication flexibility so key personnel can work at the direction of the State's and watershed organization's Project Leaders. Of course, scope and budget changes will be administered in accordance with accepted change order processes.
- **Issue purchase orders with clearly defined work scopes**. Purchase orders (POs) are issued from the OASIS Wind2Soft accounting system, and our subcontract requires issuance of a PO to authorize a work scope. Terms and conditions of the OASIS subcontract agreement are incorporated by reference into the PO. The work scope is defined or referenced by the PO. A change to the PO will be required to accommodate any budget or work scope changes. This requirement ensures project controls are in place, and changes are clearly communicated.
- **Require labor hours and costs forecasting**. Subcontractors will be required to provide labor and hour forecasts. Forecasts will need to be provided with enough lead time so that OASIS can combine data into a comprehensive report to the Project Leader. Smaller projects may not require this level of control. Reporting deadlines for each month will be identified in advance. These forecasts will alert OASIS (and in turn the State of Montana, as necessary) of any potential budget variances or issues so that we can work with the team members toward resolution.
- **Require cost tracking and reporting in a timely manner**. Our subcontractors will be required to track and report costs. They will also be required to provide backup according to a time schedule and prescribed format. Prescribed reporting formats will enable OASIS to effortlessly incorporate the subcontractor's cost information into our reporting systems.

The following project execution plan provides a high-level overview of the approach we will incorporate into the work process for each scope of work category. Key components of the project management and control process are provided below:

- **Schedules and schedule control** – develop baseline schedules, and update as needed.
- **Measure physical progress of work** – consider tasks completed compared to budget milestones.
- **Cost estimating** – develop cost estimates and budgets for work.
- **Cost control** – compare expended funds and forecasted expenditures to trend cost status, and take corrective action as necessary; periodically meet with Company's PL.
- **Progress and cost report** – establish management-by-exception reporting system to provide narrative discussion, graph of progress versus time, tabular summary of budgeted hours to actual hours expended, graph of manpower loading versus time, schedule updates, cost-status tabulation and work-in-place projections versus time. Also includes an indicator tabulation, which identifies the productivity and the percent earned progress.
- **Change control mechanism** - defines the process and format for requesting or defining changes to the work scope.

Microsoft Project® schedules showing planned timing of program activities will be prepared, as necessary. OASIS has the expertise to prepare detailed program schedules, if necessary, illustrating critical paths and task associated with the performance of work.

Our standard project execution plan is organized into four phases that are important in any comprehensive environmental management program: 1) Planning and Scheduling; 2) Execution and Implementation; 3) Reporting and Review; and 4) Implementation of Corrective Action (if required). Table 0.1 outlines the OASIS approach to these project phases and the important elements of each phase utilized to ensure a project's success, with extra consideration given particularly to management of field projects.

Staff Qualifications

The staff proposed to support projects targeted by this RFP are presented in summary in Table 0.2. Staff qualifications, credentials, and identified team roles are also presented in a table specific to each service category. Detailed resumes for each staff member identified to support the service category are provided in Appendix F.

Table 0.1: OASIS Project Implementation Approach

1. Planning and Scheduling - Comprehensive planning and scheduling, which considers end objectives, is essential for project success.
a) Define Project Objectives and Milestones
Agree upon level of effort and definition of work scope. A mutual understanding of expectations is necessary to ensure all parties are satisfied. It is imperative to engage in planning sessions where details of the tasks, the nature of the work, and key milestones are clearly defined.
Issue purchase orders with clearly defined work scopes. Purchase orders are issued from the OASIS Wind2Soft accounting system, and our subcontract requires issuance of a PO to authorize a work scope. Terms and conditions of the OASIS subcontract are incorporated by reference. The work scope is defined or referenced by the PO. A change to the PO will be required to accommodate any budget or work scope changes. This requirement ensures project controls are in place, and changes are clearly communicated.
As requested, **support the State of Montana and watershed groups in meetings with agencies/stakeholders to identify expectations**. To avoid data gaps and unmet expectations, it is important to discuss our planned field activities and data quality objectives, with applicable agency, stakeholder, and community members.
Clearly identify project objectives in terms of level of data "density" required. Results become more precise when more data are collected. However, there is a point of diminishing return when the cost of acquiring the increased data precision is more than the savings provided by the more precise data.
b) Optimize Schedules
Coordinate schedules of multiple jobs so efficiency can be maximized. Mobilization costs are particularly high for jobs in remote areas. By coordinating tasks and/or sites with similar needs, the cost of mobilization and the impact to the schedule can be minimized. The OASIS team will make efficient use of it geographic locations in the northwest and southwestern Montana locations.
Identify high-usage times for supplied equipment (e.g. heavy equipment, instrumentation). Many projects occur simultaneously and they typically draw upon a common pool of resources. At the planning stage, verify availability of resources (which will vary seasonally) and then optimize the schedule depending on objectives and limitations.
c) Coordinate Required Work Approvals
Schedule adequate time for documentation review. To perform work at the state level, various types of approvals may be needed from different personnel and divisions within the state. The OASIS team will identify critical path items, and make every reasonable effort to provide key information as early in the project execution process as possible.
Engage the document approving personnel at an early stage. OASIS realizes that if the approving personnel are identified and coordinated with early in the process, the review period will typically be shortened. The ramifications of unapproved permits and plans can ripple throughout the project schedule and may cause work to be delayed from a few days up to as much as a full field season.
d) Coordinate with Subcontractors
Assign appropriate staff from the pool of OASIS team resources. We plan to "right size" the team for the project/task to be done. We will assign professionals with experience at the correct expertise level, without allocating inexperienced, inappropriate, or "too many" personnel to the job. This approach has been our culture, and we will carry it forward on this contract.
Identify work scope, level of data quality, and performance expected of subcontractors. Prior to commencing work, establish expectations with each subcontractor, and other project participants. Objectives such as the level of accuracy and the preferred coordinate system needed from surveyors, desired laboratory turnaround times, and required equipment from heavy equipment subcontractors (with verification of operational status). The anticipated levels of effort from ADC, as well as other professional services subcontractors, if applicable, must be established and documented in work scopes.
Verify that each subcontractor has properly addressed program-level HSE requirements. Subcontractors will be required to provide HSE reporting information to OASIS on a regular basis. Project-specific HSE requirements will be communicated to all subcontractors working on the project, prior to mobilizing for field work.
Provide flexibility in client-subcontractor communications. OASIS will encourage direct communication between the client and teaming subcontractors to the level necessary for project success. OASIS will provide this flexibility so key personnel can work at the direction of the State of Montana or watershed group project leaders, although any work scope authorizations will necessarily go through contractual (PO) procedures. So to achieve satisfactory project execution, OASIS will participate in the process to initiate or modify subcontractor work scopes.
e) Address HSE Requirements
Address HSE requirements early in project planning. OASIS plans to develop a draft HSE document before mobilizing to any project site. Fit for purpose pre-job meetings will be held.
Routinely perform a hazard analyses. As standard practice OASIS will perform a hazard analysis on each work scope, considering site-specific/job-specific situations so that safety is considered in all aspects of the project.
Identify key HSE personnel early in project planning. As with many aspects of this project, early coordination with key personnel will facilitate a timely meeting to review and permit requirements and our Project HSE Plan. Early planning allows time for schedules to be arranged to accommodate meetings.

f) Staff the Project Team	
	Assign experienced project personnel. Labor dollars are saved when the selected personnel are experienced, qualified, and in tune to the requirements of the working environment.
	Maintain continuity of project staff. Positive relationships established go a long way toward making a project effort efficient and cost effective. The OASIS Team has been successful at minimizing staff turnover and can therefore assure the State of Montana that they can provide continuity of field/project team personnel.
g) Coordinate Logistics	
	Coordinate with the laboratory and other time-critical subcontractors. We will work with laboratories and other time-critical subcontractors to prepare a comprehensive list of analytical sampling needs and equipment requirements. From this list we will determine needed laboratory supplies such as sample bottles, coolers, ice, and preservatives, and/or specialized monitoring or heavy equipment requirements. This coordination will take place early in the planning stage so that enough time is available ensure timely delivery of services for project milestones.
	Prepare materials and supplies checklist. Each field task will be thoroughly reviewed to determine all other required materials and supplies. Before procurement, a thorough review of existing materials and supplies will be performed. Only after determining existing resources will we procure the remaining materials and supplies. This will help to avoid incurring unnecessary expenses on the project.
	Verify HSE materials and supplies. Field crew members will have adequate equipment "on their person" when traveling. Provisions will be made during the planning stages of the project to ensure that each field team member has appropriate field safety and communications gear available for use.
	Test calibration and function of field instruments. It is imperative to verify proper operation and calibration before sending field instruments to a project site. To avoid schedule delays, a "back up" instrument may be provided when such instrument is critical to maintaining the schedule (e.g., field monitoring instrument during a water quality monitoring event).
	Consolidate and mobilize equipment and supplies. Materials with special shipping requirements such will be shipped far enough in advance to account for potential delays. Where possible, other materials and supplies will be consolidated in Bigfork or Livingston, inventoried, and transported all together to the site – reducing the chance of lost individual items.
2. Execution and Implementation	
a) Inventory and Prepare Field Gear	
	Verify arrival of all equipment/supplies shipments. As soon as the field team arrives on site, they will confirm that all needed equipment and supplies have arrived at the shipping point or work site. This up front inventory will allow the team time to acquire missing supplies, if necessary, before the schedule is affected.
	Check and, as necessary, calibrate field instrumentation. After the field crew arrives to the site, instruments will be checked to verify they were not damaged in shipment. Calibration will be verified or performed, as necessary.
	Pre-pack supplies and sample bottles. To streamline daily field operations, coolers will periodically be packed with all needed bottle and/or supplies for multiple days worth of sampling and other project work. This up-front organization will help to identify depleted supplies farther in advance and will shorten daily preparation time, which is critical when other parties are waiting for the project team.
b) Review Critical Documents and HSE Procedures	
	Verify proper documentation is on hand. Relevant documentation, from work plans, to Project HSE Plans, to field permits must be accessible when working at a project site so that when a question or issue arises, the project team has the necessary guidance to move forward without significant schedule delays.
	Review established schedules and work activity sequences. Coordination among the diverse groups responsible for work can be challenging. For example, if activities are not properly sequenced, unnecessary delays and costs can be incurred.
	Final review of work plan and HSE Interface Document. It is imperative to verify a clear understanding of project objectives before kicking off a project field effort. Also, while on site, the Project HSE Plan will be reviewed and signed off before initiating work, then briefly reviewed daily before starting work. Key contacts, phone numbers, and preferred (available) communication methods (cell phone, radios, truck radios, etc.) will be confirmed once the field team is on site, as necessary.
c) Hold Daily Tailgate Meetings	
	Review daily weather conditions and discuss contingency plans. Weather delays sometimes occur during winter, and occasionally occur during summer field seasons. Safety is the main issue in these situations. When weather delays do occur, professional personnel will accomplish non-field project work tasks so that the time should not be "wasted". Technical support staff will use this time to organize equipment and pre-pack supplies/sample bottles for future tasks. For subcontractors such as heavy equipment personnel, advanced preparations and equipment maintenance will be performed when possible to minimize true standby time.
	Discuss potential hazards that could be encountered. The possible hazards of the job and at the job site will be reviewed daily.
	Inventory and discuss required safety gear, communication. The method of communication and emergency procedures will be reviewed with the project team daily. Required gear will be determined on a task-specific basis (e.g., proper winter clothing, survival bag if being dropped off at a remote site, etc.).

	Plan for meals and refreshments. The field team leader will verify that the field crew has planned for food and water/drinks, if efficient work timing during the day will not enable return to a populated area.
d) Practice Proper Field Data Documentation	
	Establish note-taking guidelines. The field notebooks we use to document our observations and daily project activities must be maintained as a document that could withstand legal scrutiny. As such, all project team personnel will follow strict documentation guidelines.
	Perform a daily review of notes and maps. At the end of each day, the project team leader will review notebooks and maps to ensure proper documentation techniques were followed and to provide guidance where needed.
e) Maintain Project Team Communication	
	Conduct regularly scheduled information exchanges. To ensure continuity of the project and total participation, the field crew and the Montana project team will communicate regularly.
	Determining the level of interaction desired by the State of Montana or watershed groups. The OASIS team intends to determine the level of and frequency of information exchanges that the State of Montana or watershed group desires so that the appropriate amount of day-to-day project involvement is provided.
f) Maintain Sample and Data Control	
	Establish proper data and sample handling techniques. All field personnel will follow work plan and QAPP directions to protect the integrity of the samples and collected data. Chains of custody will be prepared for each set of samples. If samples are to be left unattended, they will be secured in a locked area or the cooler will be sealed with tamper-detecting materials.
	Maintain regular contact with the laboratory and other time-critical project team members. The field crew will notify the laboratory when a sample shipment is expected to arrive. At a minimum when required to send samples via airline or other delayed transport means, the quantity and type of samples, the shipping company name and phone number, the waybill number(s), and the site name/project number will be conveyed to the laboratory at the time of sample shipment. After expected delivery time the field crew will contact the laboratory to check if the samples were received and in good condition.
3. Reporting and Review	
a) Review Outcome of Field Effort	
	Assess completion of project and client satisfaction. At the end of a job, original project objectives will be reviewed to assess completion of the job and to identify tasks that may not have added value. Formal feedback from the State of Montana and watershed groups will be requested in order to determine areas of needed improvement.
	Conduct a "lessons learned" session. After completion, the project team will review each field job in a "lessons learned" session. The results will be documented and placed in the project file. To support continual improvement, process improvements will be implemented on subsequent projects.
b) Compile and Review Data	
	Consolidate field data. Upon returning from a project site, the project team will compile field data sheets and field notes into usable tables of information. Data from subcontractors (surveyors, ADC, etc.) will be consolidated into data tables, as appropriate.
	Review Analytical Data. Upon receipt of analytical data, the designated OASIS chemist will verify that the data quality objectives were met and validate the data. A narrative of the data review will be developed, and data qualifiers noted.
	Data Management. As directed by the State of Montana, OASIS will coordinate with the laboratory to verify that the analytical data are in the proper format. Once it is verified that data meets data quality objectives and is in the proper format, analytical and sampling data will be uploaded or input into STORET or similar data management system.
c) Develop Reports and Data Deliverables	
	Confirm reporting deadlines. As part of the ongoing scheduling control process, the reporting deadlines will be reviewed based on expected turnaround times from the project laboratory or service contractors. The draft reporting date will be verified in comparison to the baseline schedule.
	Prepare technical reports. Technical reports will be developed with the State of Montana, watershed group, or other agency approval and provided as hard copy and electronic deliverables (for final work products).
	Prepare figures, illustrations, and GIS thematic data. OASIS' draftsperson and the surveying subcontractor will coordinate to produce quality and accurate figures and load applicable GIS data into ArcGIS.
	Prepare electronic data deliverables. OASIS' data management specialists will compile and perform QA upon all field data, GIS thematic data, and STORET sampling data deliverables prior to final submission.
	Prepare financial reports. Periodic schedule and budget status updates will be provided throughout the project, as well as cost tracking reports. Labor hours and direct/indirect costs will be forecasted for the OASIS Team. Forecasts will be provided by subcontractors with enough lead-time so that OASIS can combine data into a comprehensive report.

4. Implementation of Corrective Action, Management of Change	
	Follow-through with corrective actions. As discussed in lessons-learned sessions, corrective actions will be identified and implemented to improve performance or address any safety issues. Corrective action can occur at any stage of the project when a problem or issue is identified.
	Communicate potential issues with project team. Open communication will be maintained with the entire project team so that corrective measures can be communicated and implemented on a regular basis.
	Respond to Change Inquiry. As work progresses, changes to the work scope may be desired or required. Change proposals will be provided to the State of Montana or watershed group upon request, or as required based on project status, site conditions, etc.

Table 0.2: Proposed Staff Qualifications Summary

Name/Title	Degree(s)	Applicable Professional Registration(s) & Specialized Training	Professional Experience (years)
OASIS Environmental, Inc. Personnel			
Jeff Leety HSE Manger Principal	BS-Geology PGS-Hydrogeology	Professional Environmental Scientist c136-5193, CO 40-Hour HAZWOPPER ISO 14000 Lead Auditor Training 8-Hour HAZWOPER Refresher Course HAZWOPER site supervisor training	18
Max Schwenne Principal	BS-Chemical Engineering MS-Environmental Engineering	AICHE EPA Risk Management Program Construction Quality Management, U.S. Army Corps of Engineers Environmental Forensics Hazardous Materials Transportation, 8-Hour Hazardous Waste and Emergency Response, (HAZWOPER) General Site Worker 40 hr HAZWOPER, 8-Hour refresher course HAZWOPER, Supervisor McCoy & Associates RCRA Land Disposal Restrictions McCoy & Associates RCRA Training National Groundwater Association, Groundwater Geochemistry SESOIL Modeling	23
Dave Trudgen Principal Scientist	BS-Wildlife Biology & Management	Crisis Communication Skills. Phase I and Phase II Negotiating Environmental Agreements, MIT; Applied Fluvial Geomorphology, Series I-IV; Leadership Training and Development	28
Pat Athey Principal Scientist	BS-Botany MS-Botany	Habitat Modifications for Salmon and Trout Constructed Wetlands for Stormwater Treatment Wastewater Treatment and Constructed Wetlands Bioremediation Engineering Workshop, General Physics Corporation Computer-Based Physical Habitat Simulation System 40 Hour Health and Safety Training Course for Hazardous Waste	21
Matt Blank, EIT Civil Engineer Project Manager	B.S.-Geological Engineering M.S.-Civil Engineering Ph.D. Candidate-Civil Engineering	CFX-5 Introductory Training Course; Applied River Geomorphology short course (Rosgen, Level I); Designing and Implementing Habitat Modifications for Salmon and Trout short course (Univ. of Washington);	13

Name/Title	Degree(s)	Applicable Professional Registration(s) & Specialized Training	Professional Experience (years)
		Contractor Quality Control Training; 40-Hr Hazardous Waste and Emergency Response (HAZWOPER); General Site Worker Instruction on fish population data collection techniques (electrofishing, tagging, physical measurements, and identification) by Dr. Tom McMahon at Montana State University.	
Mike Cox, P.E. Civil Engineer Hydrologist	BS-Geological Engineering Graduate studies-Arctic Engineering	Montana Professional Engineer, CE 16910; Alaska Professional Engineer, CE 10574; 1-Dimensional Surface Water Modeling using HEC-RAS; 2-Dimensional finite element Surface Water Modeling using SMS; 8-Hour Hazardous Waste Operations Supervisor Training; CPN Radiation Safety and Use of Nuclear Gauges; Construction Quality Management for Contractors, Corps of Engineers; 40-hour Hazardous Waste Operations and Emergency Response Training	10
John Gangemi River Ecologist Project Manager	BS-Natural History MS-Environmental Studies	EPA Rapid Bioassessment Protocols R1/R4 fisheries habitat assessment ESRI ARCView Training Mutual Gains Training Interest Based Negotiations	15
Nathan Sande Environmental Scientist Project Manager	BS-Sociology/Natural Science MS-Environmental Science	ISO 14000 Lead Auditor Training 8-Hour HAZWOPER Refresher Course HAZWOPER site supervisor training, HazCat® chemical identification/categorization system (24-hour) McCoy's RCRA Training (40 hour) RCRA Land Disposal Restrictions training (8-hour) Hazardous Materials Transportation Regulations training (HM-181/126F) Hazardous Waste and Emergency Response, (HAZWOPER) General Site Worker 40 hr USACE Construction Quality Management (CQM) for Contractors	11
Susan Ives Biologist	BS-Biology	40-hour Hazardous Waste Operator and Emergency Response (HAZWOPER), 2001 Wetlands Basic Training, Wetlands Institute, 2003	3
Jane Paris, EIT Hydrologist	BS-Geophysical Eng. MS-Agricultural Eng.(Hydrogeology)	Construction Quality Management for Contractors, Corps of Engineers HAZWOPER General Site Worker 40 Hours and Annual 8-Hour Refreshers	17
Annette Sackman-Franzen Chemist	BS, Chemistry, Colorado State University, Ft. Collins, Colorado AA, Chemistry, Cloud County Community College, Concordia, Kansas	ISO 14001 EMS Lead Auditor DOT Hazardous Materials Shipping EPA HRS Training 40-Hour HAZWOPPER Innov X Systems XRF Manufacturer's Training Course Niton XRF Manufacturer's Training Course First Aid/CPR Training	18

Name/Title	Degree(s)	Applicable Professional Registration(s) & Specialized Training	Professional Experience (years)
Eppie Havel Statistician Toxicologist	BS-Environmental Studies MS-Environmental Quality Science	Risk-Based Corrective Action (RBCA) Training; McCoy's Resource Conservation and Recovery Act (RCRA) Seminar	11
Brian Anderson Hydrogeologist	B.S-Earth Science/Hydrogeology		2
ADC Services, Inc. Personnel			
Russell Smith Water Resource Specialist Principal	B.A., Environmental Conservation A.A.-Building Construction	Regulatory IV – Interagency Wetland Identification & Delineation (USCOE)	12
Tom Coleman Water Resource Engineer Principal	B.S.-Civil Engineering M.S.-Environmental Engineering	Natural Stream Channel Design (Interfluve, Inc.); Applied Fluvial Geomorphology (Rosgen, Level I); River Morphology and Application (Rosgen, Level II); River Assessment and Monitoring (Rosgen, Level III)	11
DeWitt Dominick Fluvial Geomorphologist	B.A.-Geography and Environmental Sciences M.S.-Watershed Science	Natural Stream Channel Design (Interfluve, Inc.); 40-Hr HAZWOPER NRCS Technical Service Provider: Channel & Streambank Stabilization; Surface Water Management; Vegetation Land Stabilization; Wetland Creation, Enhancement & Restoration; Wildlife & Fisheries Development, Management & Restoration	9
Drake Burford Fisheries-Wildlife Specialist	B.S.-Geohydrology M.S. Fish & Wildlife Management	The Waterloo Stream Course – Designing Stream Restoration Works, 2000; Riparian Area Management – Proper Functioning Condition Seminar, 1999; Riparian Zone Ecology, Restoration, and Management Workshop, 1998	7
Jeannette Romig Wetland Ecologist	B.S.-General Science M.S.-Earth Science	Wetland Delineation With Emphasis On Soils & Hydrology (Wetland Science Institute), 2003; Introduction To NRCS, 2004; Introduction To Water Quality (NRCS), 2004; Conservation Planning, Part 1 (NRCS), 2004; Pest Management Track, Part 1 (NRCS), 2005; Nutrient Management Track, Part 1 (NRCS), 2005; Technical Service Provider: Wetland Creation, Enhancement & Restoration;	6
Max Hjortsberg Riparian/Wetland Plant Specialist	B.A., History		3

Name/Title	Degree(s)	Applicable Professional Registration(s) & Specialized Training	Professional Experience (years)
Meghan Mutch Plant Ecologist	B.S., Horticulture	Certified Plant Professional In Training	6

Water Quality Monitoring – Fixed Station and Probabilistic Design

References

Table 0.2 provides applicable projects and references that have used and/or are using services similar to those requested by the State of Montana in the RFP. The references include State and Federal government, non-profit organizations, and private companies.

Company Profile and Experience

Please reference our general company profile presented in Section 0.

Method of Providing Services & Quality Assurance

OASIS recognizes that each fixed station monitoring project has its own objectives and challenges, where each requires development of an evaluation strategy established by a multi-disciplinary look at the project problem itself. The multi-disciplinary approach facilitates a comprehensive look at the methods to collect and evaluate the data appropriately. OASIS may utilize various methods to meet the objectives of a fixed station monitoring program, which may include the following:

- ✓ Geomorphic Assessments
- ✓ Watershed assessment using GIS-based models
- ✓ Rosgen Channel Classification
- ✓ Classification of Riparian and Wetland Communities
- ✓ Custom Database Application Design and Programming
- ✓ Biological Assessment of Water Quality
- ✓ Remote Sensing/GIS
- ✓ Surface Water Quality Sampling and Data Analysis
- ✓ Quality Assurance/Quality Control
- ✓ Stream Habitat Assessment
- ✓ Project-Specific Stream Assessment Methodologies

Fixed station water quality monitoring is an important tool in assessing the current conditions of impaired and functioning waters, water quality trends over time, and the roles and impacts of human activities and natural disturbance in influencing aquatic systems. OASIS has designed, constructed, and performed fixed station monitoring using both automated and grab sampling methods to assess conditions in streams and lakes, including parameters of temperature, DO, pH, conductivity, alkalinity, Total Suspended Solids (TSS), and Total Dissolved Solids (TDS), quantitative determination of inorganic and organic contaminants and water nutrients using laboratory analytical methods, and complete watershed evaluations that require an understanding of organic and inorganic chemicals, biological components (macroinvertebrates, algae and chlorophyll), sediment load, and trace metals. OASIS maintains an equipment inventory of portable Horiba multi-parameter water quality analyzers for use on field projects, which include parameters of temperature, pH, conductivity, dissolved oxygen, and oxidation-reduction potential (ORP).

All of OASIS' projects use Federal/State protocols and appropriate equipment to ensure representative samples are collected at all times.

Quality Assurance - QAPPs and Field Sampling Plans - Field sampling plans must clearly define the project objectives and the data quality objectives. OASIS has prepared quality assurance/quality control plans for countless projects. These plans are readily adaptable to other projects; thereby, saving money and allowing quick turnaround time. OASIS plans are intended for use by field personnel while providing detailed information needed for report writing and interpretation. The process used to develop a sampling plan includes the following steps: perform a site visit if possible, develop data quality objectives; prepare a graphic of the sample area; identify the sample locations and indicate the locations on the graphic; obtain legal access to the sampling points, specify the number, types and purpose of each sample; specify collection and preservation techniques if not addressed in the Quality Assurance Project Plan (QAPP), specify sample shipping and chain of custody procedures, describe how sample locations will be verified (e.g., surveying, GPS, landmarks),

develop a sampling schedule, develop a complete equipment and supplies list, identify a laboratory, and develop a project schedule.

Field sampling plans will be submitted to the State of Montana for approval prior to implementation. A concise and easy to understand sampling plan is crucial to a successful project. Our team's sampling plans will clearly state the project objectives, include graphics that depict the study area, and serve as the main document describing how work will be performed. Our sampling plans are essential tools used by field personnel to understand not only *what* will be performed, but *why*. Although it is recognized that a general QAPP is not required for submittal with this RFP, an OASIS QAPP may be submitted upon request by the State. All sampling plans will also contain a site safety and health plan.

Staff Qualifications

Table 0.1: Staff Qualifications – WQ, Fixed Station & Probabilistic Design

Staff Name	Degree(s)	Professional Registration(s)	Professional Experience (years)	Similar Project Experience (years)	Team Role
Max Schwenne	BS-Chemical Engineering MS-Environmental Engineering		23	14	PM
John Gangemi	BS-Natural History MS-Environmental Studies		15	9	TC
DeWitt Dominick	B.A.-Geography and Environmental Sciences M.S.-Watershed Science		9	8	SS
Susan Ives	BS-Biology		3	3	SS
Matt Blank, EIT	B.S.-Geological Engineering M.S.-Civil Engineering Ph.D. Candidate-Civil Engineering	Engineer-In-Training (EIT)	13	6	SS
Tom Coleman	B.S.-Civil Engineering M.S.-Environmental Engineering		11	7	SS

Notes: PM - Project Manager; TC – Technical Coordinator; SS – Support Staff

Table 0.2: Projects/References – WQ, Fixed Station & Probabilistic Design

Kenai River Hydrocarbon Study

OASIS performed a hydrocarbon sampling and assessment project on the Kenai River, Alaska. Water sampling was conducted from May through September, 2003 for three possible source inputs: stormwater, motorboats and boat and dock activity at the Kenai Harbor. Results were used to determine the sources contributing hydrocarbon contamination and their temporal and spatial extent.

OASIS staff collected samples for semi-volatile organic compounds and volatile organic compounds on the Kenai River using special techniques to ensure data validity. Motorboat sampling included weekly sampling events over a three-month period and a 24-hour and 72-hour sampling event. Seasonal sampling events were performed for stormwater outfalls and at the Kenai Harbor. OASIS worked closely with ADEC and other interested parties to determine sampling sites and dates. Site selection included solicitation of information on motorized activity and sensitive habitats. Sample date selection included timing sampling with storm events for storm water outfall sampling and fishery openings for sampling in the Kenai Harbor.

Reference Information

Company Name:	Alaska Department of Environmental Conservation (ADEC)
Location of Services:	Kenai, Alaska
Contact Person:	Tim Stevens
Telephone Number:	(907) 269-7515
Date(s) of Services:	2003
Key Personnel:	Max Schwenne, Sue Ives, Nathan Sande

The scope of work included: 1) developing an ADEC-approved Quality Assurance Project Plan; 2) performing field sampling for three different source inputs from May-September, 2003; 3) evaluating weather conditions from NOAA data and USGS gauging station data at sites along the river to determine conditions during sampling events using a custom database application; 5) preparing interim reports during the sampling period to notify client of draft results and determine if changes to the sampling protocols were necessary; and 6) preparing a final report including results, data validation and recommendations.

A motorboat was used to access the sampling sites along the river. Hydrocarbon samples were collected using a VOC sampler designed by the USGS specifically for flowing surface waters to minimize the effects of volatilization upon the samples and allow sampling at depth. Multi-parameter water quality meters were used to measure standard chemical parameters at all sampling events: temperature, pH, dissolved oxygen, conductivity and turbidity. Under authority of the Clean Water Act, EPA 600 series methods were used to sample water for organic contamination. Volunteers with both the Alaska Department of Fish and Game and the Kenai Watershed Forum were solicited for participating in the sampling program. OASIS field staff conducted all sampling events with the aid of volunteer support staff to minimize costs to the client. Use of volunteer support also helped to educate other agency staff on water quality issues and to work together with interested groups also performing water quality sampling on the river.

Jack Creek Ranch & Woodson Creek Wetland Mitigation Projects

The purpose of these large-scale wetland/stream mitigation projects was to provide the Montana Department of Transportation (MDT) with credits to offset wetland impacts from highway construction activities in Madison and Meagher counties. The work on Jack Creek Ranch revolved around restoring and enhancing over 9,300 feet of fluvial fish habitat, restoring the channel's hydraulic efficiency, and restoring approximately 80 acres of adjacent scrub/shrub and emergent wetlands. This project was successfully completed in 2004. Project objectives for the Woodson Creek mitigation include restoring over 10,000 feet of Woodson Creek channel, restoring the channel's hydraulic efficiency, reconnecting the creek to its historic floodplain, and restoring/enhancing over 40 acres of emergent wetlands. This project is currently in the design phase with construction expected to begin summer 2005.

Reference Information

Company Name:	Jack Creek Ranch, Ringling Land and Cattle Co., & MDT
Location of Services:	Jeffers, MT & Ringling, MT
Contact Person:	Larry Urban MDT Wetland Specialist
Telephone Number:	(406) 444-6224
Date(s) of Services:	2003 – present
Key Personnel:	Tom Coleman, Russell Smith, DeWitt Dominick, Jeannette Romig

One-meter resolution historical aerial photos from the 1950s through1997 were used during the wetland delineation for both projects to understand how the hydrology and vegetation has changed over time. Wetland and upland community boundaries were estimated from the photographs where possible and ground-truthed in the field. This information was also used to estimate the number of wetland acres that could be restored and serve as credits for the MDT wetland crediting program.

The design for the wetland portion of the restoration projects focused on returning wetland hydrology to drained wetlands in the vicinity of extensive drainage ditch systems. Aerial photographs were used to estimate the volume of fill required to disable the systems. The elimination of the ditch system on the Jack Creek Ranch has allowed subsurface and surface hydrology to return and influence the vegetative community of the field. This is also expected to occur at the Woodson Creek mitigation site.

Aerial photos were used extensively to assess each project area's watershed characteristics, stream geomorphology and floodplain extent. Pre-disturbance characteristics of the stream such as active channel width, sinuosity, channel type, and flood plain width were determined from historic aerial photographs and field data collections. Based on photo interpretation and channel bed and bank materials collected from upstream reference reaches, the target channel cross section for both streams is comparable to an E5 channel under the Rosgen Classification System. The new channel at each site was designed to follow the old meander footprint within the historic floodplain. The basic channel section was then refined through hydraulic analysis using HEC-RAS water surface profile software.

Hydropower Dam Operations/Benthic Macroinvertebrate Study

River regulation by high-head hydroelectric dams exert profound perturbative forces on the downstream riverine environment. Wide fluctuations in daily discharge as well as changes to seasonal and annual hydrographs patterns have a direct bearing on water chemistry, distribution of benthic insects longitudinally below the dam and thus food web support of fish populations.
These influences manifest throughout the riverine zoobenthic community affecting spatial and temporal distributions, behavior, productivity, reproductive success, and many other important population variables.

Reference Information

Company Name:	Montana Fish, Wildlife and Parks
Location of Services:	Flathead and Kootenai Rivers
Contact Person:	Brian Marotz
Telephone Number:	(406) 752-5501
Date(s) of Services:	1991-92 Flathead 1994-95 Kootenai
Key Personnel:	John Gangemi

Rationale for Research below Libby and Hungry Horse Dams. In the 1980's considerable research was conducted by Stanford and Hauer on the Flathead River system and Perry on the Kootenai River examining the discharge patterns from hydroelectric dams and the resulting significant ecological impact on riverine fauna. Installation of a thermal curtain on Hungry Horse Dam in the early 1990's congruent with alterations in discharge patterns warranted further research investigating the response in the benthic community. Similarly, changes in the diel and annual discharge patterns below Libby Dam triggered in part by factors related to the interconnected electrical energy network of the Northwest Power Pool and flows designed to mitigate the losses of salmon in the Lower Columbia have also warranted further investigations to document effects on the aquatic community. Comparative analyses regarding effects of recent changes in flow regimes compared with those occurring during the studies by Stanford and Hauer on the Flathead and Perry on the Kootenai.

Objectives. The purpose of these studies were two fold: 1) to determine the effect of seasonal disruption in discharge from hydropower operations combined with installation of a selective withdrawal mechanism from the reservoir water column (Flathead only) on water quality and zoobenthos distribution of the Flathead and Kootenai Rivers, and 2) to directly compare, where possible, changes in benthic species diversity and density that may have occurred in studies undertaken in the early 1980's with conditions a decade later.

Methods. Establish five sampling sites increasing in distance longitudinally downstream from the respective dams. A sixth sample site not subjected to the discharge fluctuations or selective reservoir withdrawal was established as a reference site for each river system. Sites were sampled monthly for a 1.5 year period. Benthic macroinvertebrates were sampled in riffle areas at each site using a modified kick-net technique designed specifically for large river systems with cobble substrate. Benthic macroinvertebrate stranding resulting from wetted perimeter fluctuations in the varial zone was quantified on each monthly sampling period. Benthic macroinvertebrate drift was also measured at each site. Water quality was sampled monthly (nutrients--SRP, total P, NO2, NO3, NH4, total N, POC, DOC-- dissolved oxygen, turbidity, pH, conductivity, alkalinity). Total suspended solids (TSS) were sampled and fractionated into ecologically relevant size classifications for benthic macroinvertebrate utilization.

Effects of Global Climate Change on Aquatic Ecosystems

The distribution of aquatic organisms is highly dependent on surface water chemistry and physical factors. In mountain landscapes the chemical and physical conditions, i.e., stream discharge, temperature and water chemistry, change along an elevation gradient. Aquatic species in turn are distributed along the stream continuum paralleling the elevation gradient. Many of these species have very narrow habitat requirements. Hydrologic and thermal variation driven by climatic change may shift aquatic habitats along the elevation gradient and potentially eliminate some habitat and associated species. The pristine McDonald Creek drainage in Glacier National Park served as an excellent watershed for establishing reference sites for studying the potential effect of global climate change on aquatic species distribution and habitats.
Objectives:

Reference Information

Company Name:	Glacier National Park/U.S. Biological Survey
Location of Services:	Glacier National Park
Contact Person:	Dan Fagre
Telephone Number:	406-888-7922
Date(s) of Services:	1992-1996
Key Personnel:	John Gangemi

- Delineate the distribution and abundance of aquatic species and habitats along an elevation gradient and predict habitat shifts associated with climatic changes.
- Establish numeric standards for surface water quality reference sites along an elevation gradient.
- Quantify monthly and annual surface water discharge at reference sites along an elevation gradient.
- Predict the effect of changes in monthly and annual surface water discharge on water quality metrics and resulting shifts and potential elimination in habitat for aquatic biota.

Methods. Establish eight primary stream reference sites along elevation gradient in McDonald Creek watershed in Glacier National Park for long-term monitoring of stream discharge, water temperature, water quality parameters (nutrients--SRP, total P, NO2, NO3, NH4, total N, POC, DOC-- dissolved oxygen, turbidity, pH, conductivity, alkalinity), macrozoobenthos and periphyton. Rating curves were developed for measuring stream discharge at each respective reference site. Automatic data recorders were programmed for each site equipped with stage height and thermal sensors. Sites were sampled monthly over a four-year period. Laboratory analysis included water chemistry, chlorophyll a analysis using spectrophotometer and fluorometric techniques as well as taxonomy and enumeration of algae, zooplankton and macrozoobenthos.

King Salmon Air Station Aquatic Biota Evaluations

OASIS performed a human food chain, aquatic biota, and wetlands evaluation and a follow-up focused aquatic biota sampling project at King Salmon Air Station, Alaska. Initial sampling and assessment work began in the spring of 1996 and continued through the fall of 1997. A follow-up focused assessment of contaminant levels in fish, surface water, and sediments in two streams was performed in 1999 and 2000.

A multidiscipline team of OASIS scientists responded to the client's needs for developing and implementing a detailed work plan and sample design for assessing contamination in locally-harvested subsistence foods, salmon and trout in local streams, and wetland areas. Local residents were interviewed and historical records were researched to determine the extent of local use of the areas and the types of subsistence foods typically present.

The scope of work included: 1) field collection of edible berries and mushrooms growing at five sites that are potentially used by local residents for subsistence activities; 2) evaluation of contamination levels in soil, sediment, and surface water in wetland areas at the sites; 3) evaluation of background sediment and surface water conditions, 4) field collection and laboratory evaluation of contaminants in silver salmon fry, blackfish, rainbow trout, bivalves and other aquatic invertebrates found in creeks; 5) characterizing and mapping the wetlands and other ecological communities that occupy each site; 6) delineating the boundaries of wetlands and upland areas based upon Clean Water Act Section 404 definitions; 7) identifying unique or special habitats at each site, 8) development of comprehensive environmental assessment reports, and 9) negotiations with regulators regarding the meaning of the data and the need for additional work.

Reference Information

Company Name:	611th Civil Engineer Squadron, USAF
Location of Services:	King Salmon, Alaska
Contact Person:	David Herzog
Telephone Number:	(907) 552-4489
Date(s) of Services:	1996-2000
Key Personnel:	Max Schwenne, Pat Athey, Jane Paris

Benzene, PCBs and organochlorine pesticides were detected in selected subsistence foods including blueberries, cranberries, salmon and trout. Special laboratory methods and Semi-Permeable Membrane Devices (SPMDs) were deployed to detect extremely low levels of organic contaminants in surface water. The low detection levels were needed to determine the ambient concentrations of volatiles and chlorinated compounds in surface water. The data were used to focus in on the source of contamination.

Contaminants that were detected in fish and plant tissue, sediment, and water were compared to a variety of screening criteria. Fish tissue results were screened against FDA action levels and fish tainting threshold concentrations for human health criteria based on ingestion. Fish tissue results were also screened against ecological ingestion screening values. Water results were screened against human health and ecological screening criteria available from the EPA and Oak Ridge National Laboratories (ORNL), and sediment results were screened against ecological screening criteria. A small proportion of samples exceeded the screening criteria for organochlorine pesticides, PBCs, and fuel constituents; generally, the frequency of detections and concentrations at locations immediately downgradient of suspected source areas are higher than those observed at distant downgradient locations, which supports the concept of natural attenuation of chemicals migrating from source areas. EPA CERCLA Risk Assessment methodology calculations were applied to the aquatic biota sample results. Relative concentrations of organochlorine compounds in tissue, water and sediments from water bodies were found to generally adhere to bioaccumulation fugacity models reported in the open literature, and the background (upstream) concentrations detected in flowing waters were within the range reported to result from atmospheric deposition in arctic regions.

OASIS participated in high-level discussions with state and federal resource agencies, including EPA Region 10 and National Marine Fisheries Service where the results of the study were discussed. OASIS also presented the results of the study at public meetings in King Salmon. Local people acknowledged the validity and methodology used in the study.

Buskin Beach Remedial Investigation & Corrective Action

OASIS supported the USACE in the development and implementation of a Remedial Investigation and Corrective Action at formerly used defense sites located at Buskin Beach, Kodiak Island, Alaska. The work was performed under subcontract to Jacobs Engineering Group in support of their USACE TERC. OASIS responsibilities included work plan preparation, field operations, evaluation of data, identification of remedial alternatives, and preparation of the RI report.

An office was established in Kodiak, complete with material supplies, networked communication systems, equipment, and a field support vehicle, to support this and other projects on Kodiak Island. The RI field program was implemented November 1998, and groundwater, surface water, sediment, and soil gas monitoring events were performed in June, August, and October 1999.

Reference Information

Company Name:	Jacobs Engineering, Inc.
Location of Services:	Kodiak, Alaska
Contact Person:	Pete Hannon
Telephone Number:	(907) 563-3322
Date(s) of Services:	1997-2001
Key Personnel:	Nathan Sande
	Matt Blank

The RI was focused on determining the extent of impact to soil and groundwater at 56 former UST sites, two former motor pool lube pits, and a former battery disposal site. OASIS implemented an intrinsic remediation study/field program that included the collection and laboratory analysis of over 600 surface and subsurface soil samples, the installation and monitoring of 150 soil gas probes, establishment of over 30 fixed station sediment/surface water sites, and the installation and sampling of 101 microwells. Data gathered during the remedial investigation was used to evaluate intrinsic remediation potential, support selection of remedial alternatives, validate the conceptual site model, evaluate risk, evaluate ARARS, and develop RA strategies. The presence of extremely shallow, fractured bedrock and shallow groundwater at the site required innovative solutions to evaluate the site's conditions and determination of suitable corrective action alternatives.

Additionally, OASIS developed and supported implementation of corrective action for the facility in 2000. OASIS wrote the removal action work plan and provided construction oversight and field services during the effort. RA services provided by OASIS included:

- Development and completion of a work plan to remove soils contaminated with fuels at concentrations above risk-based cleanup levels previously calculated by OASIS personnel. The removal effort focused upon excavation of soils at 27 separate and unique former UST sites, requiring specific attention to protected historic structures, previously documented depth and lateral contamination extents, and removal complications generated by shallow groundwater;
- Provided direction and oversight for field construction crews in the removal of approximately 12,000 cubic yards of fuel-contaminated soil, two USTs, subsequent site restoration activities, and surveying activities;
- Directed and provided oversight for waste-management contractors in the follow-up management of wastes generated by the project.
- Completion of final reporting

Water Quality Monitoring – Lakes and Streams

References

Table 0.4 provides applicable projects and references that have used and/or are using services similar to those requested by the State of Montana in the RFP. The references include State and Federal government, non-profit organizations, and private companies.

Company Profile and Experience

Please reference our general company profile presented in Section 0.

Method of Providing Services & Quality Assurance

Lake and stream monitoring requires recognition of watershed conditions over a much larger scale than fixed station monitoring activities, and requires that the data collection approach is carefully designed to meet the objectives of this scale. Doing so requires a combination of disciplines to design an approach to include evaluation of watershed characteristics, stream geomorphology, floodplain characteristics, and riparian habitats using various field and remote sensing methods such as Rosgen and GIS imagery analysis.

OASIS recognizes that each lake & stream monitoring project has its own objectives and challenges, where each requires development of an evaluation strategy established by a multi-disciplinary look at the project problem itself. The multi-disciplinary approach facilitates a comprehensive look at the methods to collect and evaluate the data appropriately. OASIS may utilize various methods to meet the objectives of a watershed monitoring program, which may include the following:

- ✓ Geomorphic Assessments
- ✓ Watershed assessment using GIS-based models
- ✓ Rosgen Channel Classification
- ✓ Classification of Riparian and Wetland Communities
- ✓ Custom Database Application Design and Programming
- ✓ Biological Assessment of Water Quality
- ✓ Remote Sensing/GIS
- ✓ Surface Water Quality Sampling and Data Analysis
- ✓ Quality Assurance/Quality Control
- ✓ Stream Habitat Assessment
- ✓ Project-Specific Stream Assessment Methodologies

Quality Assurance - QAPPs and Field Sampling Plans - Field sampling plans must clearly define the project objectives and the data quality objectives. OASIS has prepared quality assurance/quality control plans for countless projects. These plans are readily adaptable to other projects; thereby, saving money and allowing quick turnaround time. OASIS plans are intended for use by field personnel while providing detailed information needed for report writing and interpretation. The process used to develop a sampling plan includes the following steps: perform a site visit if possible, develop data quality objectives; prepare a graphic of the sample area; identify the sample locations and indicate the locations on the graphic; obtain legal access to the sampling points, specify the number, types and purpose of each sample; specify collection and preservation techniques if not addressed in the Quality Assurance Project Plan (QAPP), specify sample shipping and chain of custody procedures, describe how sample locations will be verified (e.g., surveying, GPS, landmarks), develop a sampling schedule, develop a complete equipment and supplies list, identify a laboratory, and develop a project schedule.

Field sampling plans will be submitted to the State for approval prior to implementation. A concise and easy to understand sampling plan is crucial to a successful project. Our team's sampling plans will clearly state the project objectives, include graphics that depict the study area, and serve as the main document describing how work will be performed. Our sampling plans are essential tools used by field personnel to understand not only *what* will be performed, but *why*. Although it is recognized that a general QAPP is not required for submittal with this RFP, an OASIS QAPP may be submitted upon request by the State. All sampling plans will also contain a site safety and health plan.

Staff Qualifications

Table 0.3: Staff Qualifications – WQ, Lakes and Streams

Staff Name	Degree(s)	Professional Registration(s)	Professional Experience (years)	Similar Project Experience (years)	Team Role
Max Schwenne	BS-Chemical Engineering MS-Environmental Engineering		23	14	PM
John Gangemi	BS-Natural History MS-Environmental Studies		15	9	TC
DeWitt Dominick	B.A.-Geography and Environmental Sciences M.S.-Watershed Science		9	8	SS
Susan Ives	BS-Biology		3	3	SS
Matt Blank, EIT	B.S.-Geological Engineering M.S.-Civil Engineering Ph.D. Candidate-Civil Engineering	Engineer-In-Training (EIT)	13	6	SS
Tom Coleman	B.S.-Civil Engineering M.S.-Environmental Engineering		11	7	SS

Notes: PM - Project Manager; TC – Technical Coordinator; SS – Support Staff

Table 0.4: Projects/References – WQ, Lakes and Streams

Big Lake/Lake Lucille Impact Study

The purpose of this project is to further assess the impacts of recreational use and shoreline development on Lake Lucille and Big Lake located in the Matanuska Valley of Alaska. This study involved preparation of a QAPP and sampling plans, sampling events through October 2005 at Big Lake, sampling events through March 2006 at Lake Lucille, evaluation of a comprehensive list of analytical and water quality parameters, compilation of weather data, and draft and final reports.

Data is being used to answer a series of questions that will help to manage source inputs in the lakes:

- What sources are contributing to target pollutants (including nutrients, fecal bacterial indicators, and hydrocarbons)? At what concentrations?
- Where and when are target pollutant levels the highest?
- Are there background levels of target pollutants in the lakes?
- Are sensitive resource areas being impacted? Are target pollutant concentrations in sensitive areas higher or lower than in the rest of the lakes?
- How do the levels of pollutants and other parameters relate to state water quality standards (18 AAC 70 as amended through June 26, 2003)?

Reference Information

Company Name:	Alaska Department of Environmental Conservation (ADEC)
Location of Services:	Matanuska Valley, Alaska
Contact Person:	Jeff Hock
Telephone Number:	(907) 465-5185
Date(s) of Services:	2004-2005 (ongoing)
Key Personnel:	Max Schwenne, Sue Ives

Weather data will be used to determine the effects of storm events in contributing pollution in the form of storm water runoff to the river. Results will be used by ADEC staff and other agencies to make management decisions that will protect the lakes and their resources from pollutants.

Kenai River Hydrocarbon Study

OASIS performed a hydrocarbon sampling and assessment project on the Kenai River, Alaska. Water sampling was conducted from May through September, 2003 for three possible source inputs: stormwater, motorboats and boat and dock activity at the Kenai Harbor. Results were used to determine the sources contributing hydrocarbon contamination and their temporal and spatial extent.

OASIS staff collected samples for semi-volatile organic compounds and volatile organic compounds on the Kenai River using special techniques to ensure data validity. Motorboat sampling included weekly sampling events over a three-month period and a 24-hour and 72-hour sampling event. Seasonal sampling events were performed for stormwater outfalls and at the Kenai Harbor. OASIS worked closely with ADEC and other interested parties to determine sampling sites and dates. Site selection included solicitation of information on motorized activity and sensitive habitats. Sample date selection included timing sampling with storm events for storm water outfall sampling and fishery openings for sampling in the Kenai Harbor.

Reference Information

Company Name:	Alaska Department of Environmental Conservation (ADEC)
Location of Services:	Kenai, Alaska
Contact Person:	Tim Stevens
Telephone Number:	(907) 269-7515
Date(s) of Services:	2003
Key Personnel:	Max Schwenne, Sue Ives, Nathan Sande

The scope of work included: 1) developing an ADEC-approved Quality Assurance Project Plan; 2) performing field sampling for three different source inputs from May-September, 2003; 3) evaluating weather conditions from NOAA data and USGS gauging station data at sites along the river to determine conditions during sampling events using a custom database application; 5) preparing interim reports during the sampling period to notify client of draft results and determine if changes to the sampling protocols were necessary; and 6) preparing a final report including results, data validation and recommendations.

A motorboat was used to access the sampling sites along the river. Hydrocarbon samples were collected using a VOC sampler designed by the USGS specifically for flowing surface waters to minimize the effects of volatilization upon the samples and allow sampling at depth. Multi-parameter water quality meters were used to measure standard chemical parameters at all sampling events: temperature, pH, dissolved oxygen, conductivity and turbidity. Under authority of the Clean Water Act, EPA 600 series methods were used to sample water for organic contamination. Volunteers with both the Alaska Department of Fish and Game and the Kenai Watershed Forum were solicited for participating in the sampling program. OASIS field staff conducted all sampling events with the aid of volunteer support staff to minimize costs to the client. Use of volunteer support also helped to educate other agency staff on water quality issues and to work together with interested groups also performing water quality sampling on the river.

King Salmon Air Station Aquatic Biota Evaluations

OASIS performed a human food chain, aquatic biota, and wetlands evaluation and a follow-up focused aquatic biota sampling project at King Salmon Air Station, Alaska. Initial sampling and assessment work began in the spring of 1996 and continued through the fall of 1997. A follow-up focused assessment of contaminant levels in fish, surface water, and sediments in two streams was performed in 1999 and 2000.

A multidiscipline team of OASIS scientists responded to the client's needs for developing and implementing a detailed work plan and sample design for assessing contamination in locally-harvested subsistence foods, salmon and trout in local streams, and wetland areas. Local residents were interviewed and historical records were researched to determine the extent of local use of the areas and the types of subsistence foods typically present.

Reference Information

Company Name:	611th Civil Engineer Squadron, USAF
Location of Services:	King Salmon, Alaska
Contact Person:	David Herzog
Telephone Number:	(907) 552-4489
Date(s) of Services:	1996-2000
Key Personnel:	Max Schwenne, Pat Athey, Jane Paris

The scope of work included: 1) field collection of edible berries and mushrooms growing at five sites that are potentially used by local residents for subsistence activities; 2) evaluation of contamination levels in soil, sediment, and surface water in wetland areas at the sites; 3) evaluation of background sediment and surface water conditions, 4) field collection and laboratory evaluation of contaminants in silver salmon fry, blackfish, rainbow trout, bivalves and other aquatic invertebrates found in creeks; 5) characterizing and mapping the wetlands and other ecological communities that occupy each site; 6) delineating the boundaries of wetlands and upland areas based upon Clean Water Act Section 404 definitions; 7) identifying unique or special habitats at each site, 8) development of comprehensive environmental assessment reports, and 9) negotiations with regulators regarding the meaning of the data and the need for additional work.

Benzene, PCBs and organochlorine pesticides were detected in selected subsistence foods including blueberries, cranberries, salmon and trout. Special laboratory methods and Semi-Permeable Membrane Devices (SPMDs) were deployed to detect extremely low levels of organic contaminants in surface water. The low detection levels were needed to determine the ambient concentrations of volatiles and chlorinated compounds in surface water. The data were used to focus in on the source of contamination.

Contaminants that were detected in fish and plant tissue, sediment, and water were compared to a variety of screening criteria. Fish tissue results were screened against FDA action levels and fish tainting threshold concentrations for human health criteria based on ingestion. Fish tissue results were also screened against ecological ingestion screening values. Water results were screened against human health and ecological screening criteria available from the EPA and Oak Ridge National Laboratories (ORNL), and sediment results were screened against ecological screening criteria. A small proportion of samples exceeded the screening criteria for organochlorine pesticides, PBCs, and fuel constituents; generally, the frequency of detections and concentrations at locations immediately downgradient of suspected source areas are higher than those observed at distant downgradient locations, which supports the concept of natural attenuation of chemicals migrating from source areas. EPA CERCLA Risk Assessment methodology calculations were applied to the aquatic biota sample results. Relative concentrations of organochlorine compounds in tissue, water and sediments from water bodies were found to generally adhere to bioaccumulation fugacity models reported in the open literature, and the background (upstream) concentrations detected in flowing waters were within the range reported to result from atmospheric deposition in arctic regions.

OASIS participated in high-level discussions with state and federal resource agencies, including EPA Region 10 and National Marine Fisheries Service where the results of the study were discussed. OASIS also presented the results of the study at public meetings in King Salmon. Local people acknowledged the validity and methodology used in the study.

Jack Creek Ranch & Woodson Creek Wetland Mitigation Projects

The purpose of these large-scale wetland/stream mitigation projects was to provide the Montana Department of Transportation (MDT) with credits to offset wetland impacts from highway construction activities in Madison and Meagher counties. The work on Jack Creek Ranch revolved around restoring and enhancing over 9,300 feet of fluvial fish habitat, restoring the channel's hydraulic efficiency, and restoring approximately 80 acres of adjacent scrub/shrub and emergent wetlands. This project was successfully completed in 2004. Project objectives for the Woodson Creek mitigation include restoring over 10,000 feet of Woodson Creek channel, restoring the channel's hydraulic efficiency, reconnecting the creek to its historic floodplain, and restoring/enhancing over 40 acres of emergent wetlands. This project is currently in the design phase with construction expected to begin summer 2005.

One-meter resolution historical aerial photos from the 1950s through1997 were used during the wetland delineation for both projects to understand how the hydrology and vegetation has changed over time. Wetland and upland community boundaries were estimated from the photographs where possible and ground-truthed in the field. This information was also used to estimate the number of wetland acres that could be restored and serve as credits for the MDT wetland crediting program.

The design for the wetland portion of the restoration projects focused on returning wetland hydrology to drained wetlands in the vicinity of extensive drainage ditch systems. Aerial photographs were used to estimate the volume of fill required to disable the systems. The elimination of the ditch system on the Jack Creek Ranch has allowed subsurface and surface hydrology to return and influence the vegetative community of the field. This is also expected to occur at the Woodson Creek mitigation site.

Reference Information

Company Name:	Jack Creek Ranch, Ringling Land and Cattle Co., & MDT
Location of Services:	Jeffers, MT & Ringling, MT
Contact Person:	Larry Urban MDT Wetland Specialist
Telephone Number:	(406) 444-6224
Date(s) of Services:	2003 – present
Key Personnel:	Tom Coleman, Russell Smith, DeWitt Dominick, Jeannette Romig

Pre-disturbance characteristics of the stream such as active channel width, sinuosity, channel type, and flood plain width of the channels were determined from historic aerial photographs and ground truthed with a topographic surveys . Based on photo interpretation, reference reach topographic surveys, and channel bed and bank materials collected from upstream reference reaches, the target channel cross section for both streams is comparable to an E5 channel under the Rosgen Classification System. The new channel at each site was designed to follow the old meander footprint within the historic floodplain. The basic channel section was then refined through hydraulic analysis using HEC-RAS water surface profile software.

A pre-restoration functional habitat assessment was performed at each site using MDT rapid assessment methodologies. This provided baseline data from which an evaluation of restoration success will be determined through the long-term monitoring program. The completed restoration work on Jack Creek will be monitored for at least five years by ADC and a third party contractor as will the Woodson Creek mitigation site upon completed. As part of this monitoring program, ADC has established several photo points throughout each site to document the structural integrity of channel stability, channel form, wetland hydrology evolution, vegetation success and habitat improvements.

Hydropower Dam Operations/Benthic Macroinvertebrate Study (FLBS)

River regulation by high-head hydroelectric dams exert profound perturbative forces on the downstream riverine environment. Wide fluctuations in daily discharge as well as changes to seasonal and annual hydrographs patterns have a direct bearing on water chemistry, distribution of benthic insects longitudinally below the dam and thus food web support of fish populations.

These influences manifest throughout the riverine zoobenthic community affecting spatial and temporal distributions, behavior, productivity, reproductive success, and many other important population variables.

Rationale for Research below Libby and Hungry Horse Dams. In the 1980's considerable research was conducted by Stanford and Hauer on the Flathead River system and Perry on the Kootenai River examining the discharge patterns from hydroelectric dams and the resulting significant ecological impact on riverine fauna. Installation of a thermal curtain on Hungry Horse Dam in the early 1990's congruent with alterations in discharge patterns warranted further research investigating the response in the benthic community. Similarly, changes in the diel and annual discharge patterns below Libby Dam triggered in part by factors related to the interconnected electrical energy network of the Northwest Power Pool and flows designed to mitigate the losses of salmon in the Lower Columbia have also warranted further investigations to document effects on the aquatic community. Comparative analyses regarding effects of recent changes in flow regimes compared with those occurring during the studies by Stanford and Hauer on the Flathead and Perry on the Kootenai.

Reference Information

Company Name:	Montana Fish, Wildlife and Parks
Location of Services:	Flathead and Kootenai Rivers
Contact Person:	Brian Marotz
Telephone Number:	(406) 752-5501
Date(s) of Services:	1991-92 Flathead 1994-95 Kootenai
Key Personnel:	John Gangemi

Objectives. The purpose of these studies were two fold: 1) to determine the effect of seasonal disruption in discharge from hydropower operations combined with installation of a selective withdrawal mechanism from the reservoir water column (Flathead only) on water quality and zoobenthos distribution of the Flathead and Kootenai Rivers, and 2) to directly compare, where possible, changes in benthic species diversity and density that may have occurred in studies undertaken in the early 1980's with conditions a decade later.

Methods. Establish five sampling sites increasing in distance longitudinally downstream from the respective dams. A sixth sample site not subjected to the discharge fluctuations or selective reservoir withdrawal was established as a reference site for each river system. Sites were sampled monthly for a 1.5 year period. Benthic macroinvertebrates were sampled in riffle areas at each site using a modified kick-net technique designed specifically for large river systems with cobble substrate. Benthic macroinvertebrate stranding resulting from wetted perimeter fluctuations in the varial zone was quantified on each monthly sampling period. Benthic macroinvertebrate drift was also measured at each site. Water quality was sampled monthly (nutrients--SRP, total P, NO2, NO3, NH4, total N, POC, DOC-- dissolved oxygen, turbidity, pH, conductivity, alkalinity). Total suspended solids (TSS) were sampled and fractionated into ecologically relevant size classifications for benthic macroinvertebrate utilization.

Effects of Global Climate Change on Aquatic Ecosystems

The distribution of aquatic organisms is highly dependent on surface water chemistry and physical factors. In mountain landscapes the chemical and physical conditions, i.e., stream discharge, temperature and water chemistry, change along an elevation gradient. Aquatic species in turn are distributed along the stream continuum paralleling the elevation gradient. Many of these species have very narrow habitat requirements. Hydrologic and thermal variation driven by climatic change may shift aquatic habitats along the elevation gradient and potentially eliminate some habitat and associated species. The pristine McDonald Creek drainage in Glacier National Park served as an excellent watershed for establishing reference sites for studying the potential effect of global climate change on aquatic species distribution and habitats.

Reference Information

Company Name:	Glacier National Park/U.S. Biological Survey
Location of Services:	Glacier National Park
Contact Person:	Dan Fagre
Telephone Number:	406-888-7922
Date(s) of Services:	1992-1996
Key Personnel:	John Gangemi

Objectives:

- Delineate the distribution and abundance of aquatic species and habitats along an elevation gradient and predict habitat shifts associated with climatic changes.
- Establish numeric standards for surface water quality reference sites along an elevation gradient.
- Quantify monthly and annual surface water discharge at reference sites along an elevation gradient.
- Predict the effect of changes in monthly and annual surface water discharge on water quality metrics and resulting shifts and potential elimination in habitat for aquatic biota.

Methods. Establish eight primary stream reference sites along elevation gradient in McDonald Creek watershed in Glacier National Park for long-term monitoring of stream discharge, water temperature, water quality parameters (nutrients--SRP, total P, NO2, NO3, NH4, total N, POC, DOC-- dissolved oxygen, turbidity, pH, conductivity, alkalinity), macrozoobenthos and periphyton. Rating curves were developed for measuring stream discharge at each respective reference site. Automatic data recorders were programmed for each site equipped with stage height and thermal sensors. Sites were sampled monthly over a four-year period. Laboratory analysis included water chemistry, chlorophyll a analysis using spectrophotometer and fluorometric techniques as well as taxonomy and enumeration of algae, zooplankton and macrozoobenthos.

Drury Gulch Site Investigation and Remedial Action

OASIS supported the USACE and their prime contractor Jacobs Engineering Group in the implementation a site investigation of the Drury Gulch former solid waste and metals dumping area, at the U.S. Coast Guard (USCG) Integrated Support Center (ISC) on Kodiak Island, Alaska. OASIS was contracted by Jacobs Engineering Group to perform a site investigation to determine if environmental media were adversely impacted by past Department of Defense activities, collect data to preliminarily evaluate potential site risk to human health and the environment, and evaluate formerly used defense site liability at Drury Gulch. OASIS performed the following tasks during the site investigation:

- Aerial photograph survey;
- Identification of ARARs;
- Surface soil sampling;
- Subsurface soil sampling using hand-auger boring advancement;
- Surface water and sediment sampling;
- Final reporting; and,
- Third-party regulatory expertise in stakeholder negotiations;

Reference Information

Company Name:	Jacobs Engineering, Inc.
Location of Services:	Kodiak, Alaska
Contact Person:	Pete Hannon
Telephone Number:	(907) 563-3322
Date(s) of Services:	1999-2001
Key Personnel:	Nathan Sande, Jeff Leety, Mike Cox

OASIS performed a longitudinal survey from aerial photographs spanning 45 years, historical site photos, and local interviews. The survey identified that Drury Gulch Creek had been rerouted by solid waste dumping activities multiple times. The survey concluded that the channelization of Drury Gulch Creek facilitated extremely rapid and consistent transport of contaminants from the solid waste deposits into an important salmonid spawning habitat. Additionally, contaminated sediments were found to be deposited upon streambanks adjacent to a local elementary school frequently used by schoolchildren during recess events.

The contaminant source delineation investigation discovered widespread polychlorinated biphenyls (PCBs) and metals (lead, chromium, arsenic, cadmium) contamination throughout the site's soils and sediments previously overlooked during previous investigations. The work at Drury Gulch was time-critical in nature due to imminent risk to human and ecological health.

Interim screening levels for the site's soils, surface water, sediments, and groundwater developed prior to the investigation were re-evaluated with respect to the many ARARs applicable to the site. The site's stakeholders included the USACE (the formerly used defense sites program representative), USCG-ISC, TSCA and RCRA components of USEPA, and the ADEC. The cleanup and institutional requirements among the various contaminated environmental media, as stipulated by the various stakeholders, complicated stakeholder agreement upon the ARARs applicable to the site. OASIS provided third-party regulatory expertise throughout negotiations between the stakeholders.

Water Quality Monitoring - Reference Sites

References

Table 0.6 provides applicable projects and references that have used and/or are using services similar to those requested by the State of Montana in the RFP. The references include State and Federal government, non-profit organizations, and private companies.

Company Profile and Experience

Please reference our general company profile presented in Section 0.

Method of Providing Services & Quality Assurance

Developing reference conditions for a watershed requires characterization of biological, chemical, and physical conditions at sites where watershed impairment is at a minimum. Data collected from reference sites are paramount to developing numeric targets for TMDL development as part of a total stream reach assessment. OASIS is competent in study design, data collection activities, and statistical analysis to facilitate appropriate development of numeric TMDL targets.

OASIS recognizes that each reference site establishment project has its own objectives and challenges, where each requires development of an evaluation strategy established by a multi-disciplinary look at the project problem itself. The multi-disciplinary approach facilitates a comprehensive look at the methods to collect and evaluate the data appropriately. OASIS may utilize various methods to meet the objectives of a reference site development program, which may include the following:

- ✓ Geomorphic Assessments
- ✓ Watershed assessment using GIS-based models
- ✓ Rosgen Channel Classification
- ✓ Classification of Riparian and Wetland Communities
- ✓ Custom Database Application Design and Programming
- ✓ Biological Assessments of Water Quality
- ✓ Remote Sensing/GIS
- ✓ Surface Water Quality Sampling and Data Analysis
- ✓ Quality Assurance/Quality Control
- ✓ Habitat Assessments
- ✓ Project-Specific Stream Assessment Methodologies

Table 0.5: Staff Qualifications – WQ, Reference Sites

Staff Name	Degree(s)	Professional Registration(s)	Professional Experience (years)	Similar Project Experience (years)	Team Role
Max Schwenne	BS-Chemical Engineering MS-Environmental Engineering		23	14	PM
John Gangemi	BS-Natural History MS-Environmental Studies		15	9	TC
Mike Cox, P.E.	BS-Geological Engineering Graduate studies-Arctic Engineering	Montana Professional Engineer, CE 16910; Alaska Professional Engineer, CE 10574;	10	6	SS
DeWitt Dominick	B.A.-Geography and Environmental Sciences M.S.-Watershed Science		9	8	SS
Susan Ives	BS-Biology		3	3	SS
Matt Blank, EIT	B.S.-Geological Engineering M.S.-Civil Engineering Ph.D. Candidate-Civil Engineering	Engineer-In-Training (EIT)	13	6	SS
Tom Coleman	B.S.-Civil Engineering M.S.-Environmental Engineering		11	8	SS

Notes: PM - Project Manager; TC – Technical Coordinator; SS – Support Staff

Table 0.6: Projects/References – WQ, Reference Sites

Big Lake/Lake Lucille Impact Study

The purpose of this project is to further assess the impacts of recreational use and shoreline development on Lake Lucille and Big Lake located in the Matanuska Valley of Alaska. This study involved preparation of a QAPP and sampling plans, sampling events through October 2005 at Big Lake, sampling events through March 2006 at Lake Lucille, evaluation of a comprehensive list of analytical and water quality parameters, compilation of weather data, and draft and final reports.

Data is being used to answer a series of questions that will help to manage source inputs in the lakes:

- What sources are contributing to target pollutants (including nutrients, fecal bacterial indicators, and hydrocarbons)? At what concentrations?
- Where and when are target pollutant levels the highest?
- Are there background levels of target pollutants in the lakes?
- Are sensitive resource areas being impacted? Are target pollutant concentrations in sensitive areas higher or lower than in the rest of the lakes?
- How do the levels of pollutants and other parameters relate to state water quality standards (18 AAC 70 as amended through June 26, 2003)?

Weather data will be used to determine the effects of storm events in contributing pollution in the form of storm water runoff to the river. Results will be used by ADEC staff and other agencies to make management decisions that will protect the lakes and their resources from pollutants.

Reference Information

Company Name:	Alaska Department of Environmental Conservation (ADEC)
Location of Services:	Matanuska Valley, Alaska
Contact Person:	Jeff Hock
Telephone Number:	(907) 465-5185
Date(s) of Services:	2004-2005 (ongoing)
Key Personnel:	Max Schwenne, Sue Ives

Hydraulic/Geomorphologic Parameter Comparison - Resurrection Creek, Alaska

Matt Blank performed a river study of Resurrection Creek near Hope, Alaska. Portions of Resurrection creek had been severely impacted by almost 100 years of hydraulic mining activities. The project involved a hydraulic and geomorphologic trend analysis to evaluate mining impacts using a combination of field data collection, historic aerial photo analysis and hydraulic modeling. The study used comparisons between reference reaches and reaches disturbed by mining activity. Work tasks included establishment of 48 transects over seven miles of river. A water surface profile model of seven miles of stream was constructed using HEC-RAS. The project included detailed calibration and validation of the model with several field data sets. This model was used to compare how different flow events may or may not access the floodplain in the reference reach versus the mined reaches. A 1-mile channel reconstruction project is presently underway on Resurrection Creek.

Reference Information

Company Name:	Chugach National Forest; Seward Ranger District
Location of Services:	Hope, Alaska
Contact Person:	Eric Johansen
Telephone Number:	(907) 224-3374
Date(s) of Services:	2001 to 2002
Key Personnel:	Matt Blank

Hydropower Dam Operations/Benthic Macroinvertebrate Study

River regulation by high-head hydroelectric dams exert profound perturbative forces on the downstream riverine environment. Wide fluctuations in daily discharge as well as changes to seasonal and annual hydrographs patterns have a direct bearing on water chemistry, distribution of benthic insects longitudinally below the dam and thus food web support of fish populations.

These influences manifest throughout the riverine zoobenthic community affecting spatial and temporal distributions, behavior, productivity, reproductive success, and many other important population variables.

Rationale for Research below Libby and Hungry Horse Dams. In the 1980's considerable research was conducted by Stanford and Hauer on the Flathead River system and Perry on the Kootenai River examining the discharge patterns from hydroelectric dams and the resulting significant ecological impact on riverine fauna. Installation of a thermal curtain on Hungry Horse Dam in the early 1990's congruent with alterations in discharge patterns warranted further research investigating the response in the benthic community. Similarly, changes in the diel and annual discharge patterns below Libby Dam triggered in part by factors related to the interconnected electrical energy network of the Northwest Power Pool and flows designed to mitigate the losses of salmon in the Lower Columbia have also warranted further investigations to document effects on the aquatic community. Comparative analyses regarding effects of recent changes in flow regimes compared with those occurring during the studies by Stanford and Hauer on the Flathead and Perry on the Kootenai.

Reference Information

Company Name:	Montana Fish, Wildlife and Parks
Location of Services:	Flathead and Kootenai Rivers
Contact Person:	Brian Marotz
Telephone Number:	(406) 752-5501
Date(s) of Services:	1991-92 Flathead 1994-95 Kootenai
Key Personnel:	John Gangemi

Objectives. The purpose of these studies were two fold: 1) to determine the effect of seasonal disruption in discharge from hydropower operations combined with installation of a selective withdrawal mechanism from the reservoir water column (Flathead only) on water quality and zoobenthos distribution of the Flathead and Kootenai Rivers, and 2) to directly compare, where possible, changes in benthic species diversity and density that may have occurred in studies undertaken in the early 1980's with conditions a decade later.

Methods. Establish five sampling sites increasing in distance longitudinally downstream from the respective dams. A sixth sample site not subjected to the discharge fluctuations or selective reservoir withdrawal was established as a reference site for each river system. Sites were sampled monthly for a 1.5 year period. Benthic macroinvertebrates were sampled in riffle areas at each site using a modified kick-net technique designed specifically for large river systems with cobble substrate. Benthic macroinvertebrate stranding resulting from wetted perimeter fluctuations in the varial zone was quantified on each monthly sampling period. Benthic macroinvertebrate drift was also measured at each site. Water quality was sampled monthly (nutrients--SRP, total P, NO2, NO3, NH4, total N, POC, DOC-- dissolved oxygen, turbidity, pH, conductivity, alkalinity). Total suspended solids (TSS) were sampled and fractionated into ecologically relevant size classifications for benthic macroinvertebrate utilization.

Effects of Global Climate Change on Aquatic Ecosystems

The distribution of aquatic organisms is highly dependent on surface water chemistry and physical factors. In mountain landscapes the chemical and physical conditions, i.e., stream discharge, temperature and water chemistry, change along an elevation gradient. Aquatic species in turn are distributed along the stream continuum paralleling the elevation gradient. Many of these species have very narrow habitat requirements. Hydrologic and thermal variation driven by climatic change may shift aquatic habitats along the elevation gradient and potentially eliminate some habitat and associated species. The pristine McDonald Creek drainage in Glacier National Park served as an excellent watershed for establishing reference sites for studying the potential effect of global climate change on aquatic species distribution and habitats.

Reference Information

Company Name:	Glacier National Park/U.S. Biological Survey
Location of Services:	Glacier National Park
Contact Person:	Dan Fagre
Telephone Number:	406-888-7922
Date(s) of Services:	1992-1996
Key Personnel:	John Gangemi

Objectives:

- Delineate the distribution and abundance of aquatic species and habitats along an elevation gradient and predict habitat shifts associated with climatic changes.
- Establish numeric standards for surface water quality reference sites along an elevation gradient.
- Quantify monthly and annual surface water discharge at reference sites along an elevation gradient.
- Predict the effect of changes in monthly and annual surface water discharge on water quality metrics and resulting shifts and potential elimination in habitat for aquatic biota.

Methods. Establish eight primary stream reference sites along elevation gradient in McDonald Creek watershed in Glacier National Park for long-term monitoring of stream discharge, water temperature, water quality parameters (nutrients--SRP, total P, NO2, NO3, NH4, total N, POC, DOC-- dissolved oxygen, turbidity, pH, conductivity, alkalinity), macrozoobenthos and periphyton. Rating curves were developed for measuring stream discharge at each respective reference site. Automatic data recorders were programmed for each site equipped with stage height and thermal sensors. Sites were sampled monthly over a four-year period. Laboratory analysis included water chemistry, chlorophyll a analysis using spectrophotometer and fluorometric techniques as well as taxonomy and enumeration of algae, zooplankton and macrozoobenthos.

Jack Creek Ranch & Woodson Creek Wetland Mitigation Projects

The purpose of these large-scale wetland/stream mitigation projects was to provide the Montana Department of Transportation (MDT) with credits to offset wetland impacts from highway construction activities in Madison and Meagher counties. The work on Jack Creek Ranch revolved around restoring and enhancing over 9,300 feet of fluvial fish habitat, restoring the channel's hydraulic efficiency, and restoring approximately 80 acres of adjacent scrub/shrub and emergent wetlands. This project was successfully completed in 2004. Project objectives for the Woodson Creek mitigation include restoring over 10,000 feet of Woodson Creek channel, restoring the channel's hydraulic efficiency, reconnecting the creek to its historic floodplain, and restoring/enhancing over 40 acres of emergent wetlands. This project is currently in the design phase with construction expected to begin summer 2005.

Reference Information

Company Name:	Jack Creek Ranch, Ringling Land and Cattle Co., & MDT
Location of Services:	Jeffers, MT & Ringling, MT
Contact Person:	Larry Urban MDT Wetland Specialist
Telephone Number:	(406) 444-6224
Date(s) of Services:	2003 – present
Key Personnel:	Tom Coleman, Russell Smith, DeWitt Dominick, Jeannette Romig

One-meter resolution historical aerial photos from the 1950s through1997 were used during the wetland delineation for both projects to understand how the hydrology and vegetation has changed over time. Wetland and upland community boundaries were estimated from the photographs where possible and ground-truthed in the field. This information was also used to estimate the number of wetland acres that could be restored and serve as credits for the MDT wetland crediting program.

The design for the wetland portion of the restoration projects focused on returning wetland hydrology to drained wetlands in the vicinity of extensive drainage ditch systems. Aerial photographs were used to estimate the volume of fill required to disable the systems. The elimination of the ditch system on the Jack Creek Ranch has allowed subsurface and surface hydrology to return and influence the vegetative community of the field. This is also expected to occur at the Woodson Creek mitigation site.

Aerial photos were used extensively to assess each project area's watershed characteristics, stream geomorphology and floodplain extent. Pre-disturbance characteristics of the stream such as active channel width, sinuosity, channel type, and flood plain width were determined from historic aerial photographs and field data collections. Based on photo interpretation and channel bed and bank materials collected from upstream reference reaches, the target channel cross section for both streams is comparable to an E5 channel under the Rosgen Classification System. The new channel at each site was designed to follow the old meander footprint within the historic floodplain. The basic channel section was then refined through hydraulic analysis using HEC-RAS water surface profile software.

TMDL Targets

References

Table 0.8 provides applicable projects and references that have used and/or are using services similar to those requested by the State of Montana in the RFP. The references include State and Federal government, non-profit organizations, and private companies.

Company Profile and Experience

Please reference our general company profile presented in Section 0.

Method of Providing Services & Quality Assurance

A thorough understanding of applicable numeric and/or narrative water quality standards is paramount to development of appropriate TMDL targets for a watershed. Numeric standards established by the State for various environmental pollutants provide a somewhat straightforward approach to establishing TMDL targets with respect to human and ecological health. Narrative standards (sediment loading, nutrients, biological criteria, etc.) are not as easily established as TMDL targets, as they are naturally occurring and their thresholds are described using terms that may be interpreted differently by various watershed stakeholders.

OASIS recognizes that each TMDL target establishment project requires a multi-disciplinary approach to ensure the scientific literature gathered to evaluate beneficial use impairment is defensible, whether the watershed concerns may be related to water quantity, riparian condition, impacts of roads and bridges, etc. Evaluating these conditions requires input from human health and ecological risk assessors, hydrogeologists, geologists, statisticians, and ecologists to develop appropriate numeric targets. OASIS may utilize various methods to meet the objectives to identify TMDL targets, which may include the following:

- ✓ Geomorphic Assessments
- ✓ Watershed assessment using GIS-based models
- ✓ Rosgen Channel Classification
- ✓ Classification of Riparian and Wetland Communities
- ✓ Custom Database Application Design and Programming
- ✓ Biological Assessment of Water Quality
- ✓ Remote Sensing/GIS
- ✓ Surface Water Quality Sampling and Data Analysis
- ✓ Quality Assurance/Quality Control
- ✓ Stream Habitat Assessment
- ✓ Project-Specific Stream Assessment Methodologies

Table 0.7: Staff Qualifications – TMDL Targets

Staff Name	Degree(s)	Professional Registration(s)	Professional Experience (years)	Similar Project Experience (years)	Team Role
Max Schwenne	BS-Chemical Engineering MS-Environmental Engineering		23	14	PM
John Gangemi	BS-Natural History MS-Environmental Studies		15	9	TC
Mike Cox, P.E.	BS-Geological Engineering Graduate studies-Arctic Engineering	Montana Professional Engineer, CE 16910; Alaska Professional Engineer, CE 10574;	10	6	SS
DeWitt Dominick	B.A.-Geography and Environmental Sciences M.S.-Watershed Science		9	8	SS
Susan Ives	BS-Biology		3	3	SS
Matt Blank, EIT	B.S.-Geological Engineering M.S.-Civil Engineering Ph.D. Candidate-Civil Engineering	Engineer-In-Training (EIT)	13	6	SS
Annette Sackman-Franzen	BS, Chemistry AA, Chemistry		18	8	SS

Notes: PM - Project Manager; TC – Technical Coordinator; SS – Support Staff

Table 0.8: Projects/References – TMDL Targets

Watershed Study of Culvert Impacts to Fish Populations

Mr. Blank and Mr. Burford were research partners for a fish passage study performed by Montana State University for a project funded by the Montana Department of Transportation. The project focused on assessing how culverts were influencing fish populations across a large drainage basin in Montana. The Clearwater river drainage was selected as the project drainage because it has a large number of culvert crossings, populations of bull and westslope cutthroat trout, and a range of land ownership. All culverts above Seeley Lake were visited, and 47 culverts were selected for data collection and analysis. The field effort included hydrologic, hydraulic, geomorphologic, habitat, and biological data collection. Statistical analyses were performed including several statistical methods: Mann-Whitney tests, Wilcoxon paired-sample tests, Shapiro-Wilk tests for normality, Chi-squared tests and both simple and multiple regression analyses. Geomorphologic and habitat data were collected following procedures outlined in USFS R1/R4 and following Rosgen channel classification. Electrofishing was performed at 20 sites for comparison of fish populations above and below culverts. In addition, a direct fish passage method was developed and used to provide a more active means of assessing passage through culverts. The final report is available on-line at: http://www.mdt.state.mt.us/research/docs/research_proj/fish_passage/final_report.pdf.

Reference Information

Company Name:	Montana State University and Montana Department of Transportation
Location of Services:	Clearwater River Drainage, Seeley Lake, Montana and Mulherin Creek, Montana
Contact Person:	Dr. Joel Cahoon
Telephone Number:	(406) 994-5961
Date(s) of Services:	2002 through present
Key Personnel:	Matt Blank, Drake Burford

A second fish passage study is presently underway at Mulherin Creek near Gardiner Montana. This study is focused on passage during high flow. Mulherin creek has both resident and migratory populations of rainbow and Yellowstone cutthroat trout. The field effort includes detailed velocity mapping with 1-D and 3-D velocity meters, use of gaging stations for continuous flow monitoring and biological sampling. Fish traps and PIT tags with antennae readers placed above and below culverts are used to provide fish movement and passage data. Data analysis includes detailed fluid modeling using state of the art computational fluid dynamic (CFD) techniques.

Hydraulic/Geomorphologic Parameter Comparison - Resurrection Creek, Alaska

Matt Blank performed a river study of Resurrection Creek near Hope, Alaska. Portions of Resurrection creek had been severely impacted by almost 100 years of hydraulic mining activities. The project involved a hydraulic and geomorphologic trend analysis to evaluate mining impacts using a combination of field data collection, historic aerial photo analysis and hydraulic modeling. The study used comparisons between reference reaches and reaches disturbed by mining activity. Work tasks included establishment of 48 transects over seven miles of river. A water surface profile model of seven miles of stream was constructed using HEC-RAS. The project included detailed calibration and validation of the model with several field data sets. This model was used to compare how different flow events may or may not access the floodplain in the reference reach versus the mined reaches. A 1-mile channel reconstruction project is presently underway on Resurrection Creek.

Reference Information

Company Name:	Chugach National Forest; Seward Ranger District
Location of Services:	Hope, Alaska
Contact Person:	Eric Johansen
Telephone Number:	(907) 224-3374
Date(s) of Services:	2001 to 2002
Key Personnel:	Matt Blank

Hydropower Dam Operations/Benthic Macroinvertebrate Study

River regulation by high-head hydroelectric dams exert profound perturbative forces on the downstream riverine environment. Wide fluctuations in daily discharge as well as changes to seasonal and annual hydrographs patterns have a direct bearing on water chemistry, distribution of benthic insects longitudinally below the dam and thus food web support of fish populations.

These influences manifest throughout the riverine zoobenthic community affecting spatial and temporal distributions, behavior, productivity, reproductive success, and many other important population variables.

Reference Information

Company Name:	Montana Fish, Wildlife and Parks
Location of Services:	Flathead and Kootenai Rivers
Contact Person:	Brian Marotz
Telephone Number:	(406) 752-5501
Date(s) of Services:	1991-92 Flathead 1994-95 Kootenai
Key Personnel:	John Gangemi

Rationale for Research below Libby and Hungry Horse Dams. In the 1980's considerable research was conducted by Stanford and Hauer on the Flathead River system and Perry on the Kootenai River examining the discharge patterns from hydroelectric dams and the resulting significant ecological impact on riverine fauna. Installation of a thermal curtain on Hungry Horse Dam in the early 1990's congruent with alterations in discharge patterns warranted further research investigating the response in the benthic community. Similarly, changes in the diel and annual discharge patterns below Libby Dam triggered in part by factors related to the interconnected electrical energy network of the Northwest Power Pool and flows designed to mitigate the losses of salmon in the Lower Columbia have also warranted further investigations to document effects on the aquatic community. Comparative analyses regarding effects of recent changes in flow regimes compared with those occurring during the studies by Stanford and Hauer on the Flathead and Perry on the Kootenai.

Objectives. The purpose of these studies were two fold: 1) to determine the effect of seasonal disruption in discharge from hydropower operations combined with installation of a selective withdrawal mechanism from the reservoir water column (Flathead only) on water quality and zoobenthos distribution of the Flathead and Kootenai Rivers, and 2) to directly compare, where possible, changes in benthic species diversity and density that may have occurred in studies undertaken in the early 1980's with conditions a decade later.

Methods. Establish five sampling sites increasing in distance longitudinally downstream from the respective dams. A sixth sample site not subjected to the discharge fluctuations or selective reservoir withdrawal was established as a reference site for each river system. Sites were sampled monthly for a 1.5 year period. Benthic macroinvertebrates were sampled in riffle areas at each site using a modified kick-net technique designed specifically for large river systems with cobble substrate. Benthic macroinvertebrate stranding resulting from wetted perimeter fluctuations in the varial zone was quantified on each monthly sampling period. Benthic macroinvertebrate drift was also measured at each site. Water quality was sampled monthly (nutrients--SRP, total P, NO2, NO3, NH4, total N, POC, DOC-- dissolved oxygen, turbidity, pH, conductivity, alkalinity). Total suspended solids (TSS) were sampled and fractionated into ecologically relevant size classifications for benthic macroinvertebrate utilization.

Effects of Global Climate Change on Aquatic Ecosystems

The distribution of aquatic organisms is highly dependent on surface water chemistry and physical factors. In mountain landscapes the chemical and physical conditions, i.e., stream discharge, temperature and water chemistry, change along an elevation gradient. Aquatic species in turn are distributed along the stream continuum paralleling the elevation gradient. Many of these species have very narrow habitat requirements. Hydrologic and thermal variation driven by climatic change may shift aquatic habitats along the elevation gradient and potentially eliminate some habitat and associated species. The pristine McDonald Creek drainage in Glacier National Park served as an excellent watershed for establishing reference sites for studying the potential effect of global climate change on aquatic species distribution and habitats.

Reference Information

Company Name:	Glacier National Park/U.S. Biological Survey
Location of Services:	Glacier National Park
Contact Person:	Dan Fagre
Telephone Number:	406-888-7922
Date(s) of Services:	1992-1996
Key Personnel:	John Gangemi

Objectives:

- Delineate the distribution and abundance of aquatic species and habitats along an elevation gradient and predict habitat shifts associated with climatic changes.
- Establish numeric standards for surface water quality reference sites along an elevation gradient.
- Quantify monthly and annual surface water discharge at reference sites along an elevation gradient.
- Predict the effect of changes in monthly and annual surface water discharge on water quality metrics and resulting shifts and potential elimination in habitat for aquatic biota.

Methods. Establish eight primary stream reference sites along elevation gradient in McDonald Creek watershed in Glacier National Park for long-term monitoring of stream discharge, water temperature, water quality parameters (nutrients--SRP, total P, NO2, NO3, NH4, total N, POC, DOC-- dissolved oxygen, turbidity, pH, conductivity, alkalinity), macrozoobenthos and periphyton. Rating curves were developed for measuring stream discharge at each respective reference site. Automatic data recorders were programmed for each site equipped with stage height and thermal sensors. Sites were sampled monthly over a four-year period. Laboratory analysis included water chemistry, chlorophyll a analysis using spectrophotometer and fluorometric techniques as well as taxonomy and enumeration of algae, zooplankton and macrozoobenthos.

Fisheries Habitat Stream Inventories, Timber Sale Evaluations, BMP Audits, 319 NPSP Assessments, Fish Habitat Improvement Projects

Assessment of fisheries habitat on Flathead National Forest streams including intensive measurement of physical habitat components, assessment of physical and biological integrity of stream community, large woody debris frequency, riffle pool ratios, fish population estimates, and coordinate sensitive fish species distribution mapping on forest.

John Gangemi was a member of an inter-disciplinary team for timber sale development. Responsible for providing data on existing aquatic habitat conditions relative to sale area, insuring compliance with numeric and narrative water quality standards, and drafting alternative actions designed to protect aquatic habitat and species.

Conducted third party audit of interagency cooperative study of Best-Management Practices (BMPs) for twenty streams on Flathead National Forest. Audit focused on evaluating BMP effectiveness associated with timber harvest, road building and agricultural practices. Audit required ability to assess natural background sediment inputs verses influx of non-point sediment sources from human caused land disturbance activities along with predictions of long-term impacts on downstream fish habitat and populations.

Reference Information

Company Name:	Flathead National Forest
Location of Services:	Flathead Cty, MT
Contact Person:	Pat VanEimeren
Telephone Number:	406-387-3800
Date(s) of Services:	1992
Key Personnel:	John Gangemi

Non-point source pollution assessments of undisturbed reference streams contrasted to disturbed study reaches allowing for delineation of natural background sediment inputs verses influx of non-point sediment sources from human caused land disturbance activities.

Plan, coordinate and implement fisheries habitat improvement projects utilizing artificial placement of large woody debris and rock structures as well as suction removal of fine sediments.

Methods used include R1/R4 fish habitat assessment, Hankin and Reeves stream inventory, Wolman Pebble Counts, McNeil sediment coring, embeddedness evaluations, mark/recapture and depletion population estimate techniques and electroshocking equipment as well as review of sensitive species distribution coupled with site specific presence-absence studies.

MT DHES Non-point source pollution (319) monitoring, identification of impaired streams and development and testing of field assessment tool

This contract was part of MT DHES initial efforts to assess NPSP and inventory impaired streams. Phase 1 consisted of development and testing of MT DHES field survey tool for assessment of non-point source pollution statewide. The NPSP field assessment survey tool was developed with MT DHES staff with input from staff at U.S. Forest Service, MT Fish, Wildlife and Parks, MT Dept. of Natural Resources, Plum Creek Timber Company and river ecologist researchers at University of Montana.

Phase 2 required deployment of MT DHES non-point source pollution assessment plan in the Flathead Basin. Twenty-six streams were evaluated for NPSP and water quality impairment. A subset of streams were located in wilderness boundaries to contrast background levels of NPSP (sediments) with study reaches disturbed by human land-use practices including timber harvest, road building, agricultural practices and urban development. BMP were applied to some of the stream reaches. This comparison allowed delineation of natural background sediment inputs verses influx of non-point sediment sources from human caused land disturbance activities. The diversity of reaches exposed to a variety of land-use practices tested and refined the applicability of the NPSP assessment tool.

This NPSP field assessment tool and regional application layed the groundwork for further development of the MT DEQ NPS program integrating TMDL approaches in 1997.

Reference Information

Company Name:	Montana Dept. Health and Environmental Sciences (reorganized as MT DEQ)
Location of Services:	Flathead Cty, MT
Contact Person:	Dr. Loren Bahls
Telephone Number:	406-443-2196
Date(s) of Services:	1989
Key Personnel:	John Gangemi

Methods. Field investigations hiking lengths of 26 streams. Photographic documentation of natural and human caused non-point source sediment loading. Demarcation on aerial photos and topographic maps. Qualitative linear estimates of land disturbance areas with overland flow linkage to perennial stream channels. Qualitative assessments of stream bank condition, fisheries habitat and LWD frequency. Documentation of point source pollution on urban streams.

Narrative report, tables, photographs, aerial photos and maps submitted to MT DHES. Open file report, MT DEQ.

TMDL Source Assessment/Delineation

References

Table 0.10 provides applicable projects and references that have used and/or are using services similar to those requested by the State of Montana in the RFP. The references include State and Federal government, non-profit organizations, and private companies.

Company Profile and Experience

Please reference our general company profile presented in Section 0.

Method of Providing Services & Quality Assurance

The very notion of delineating "non-point" sources in a watershed instills uncertainty, whether estimating source contributions or identifying the source itself. A multi-disciplinary approach is required to gather an understanding of watershed impairment sources at all stages of the assessment, whether during literature review, field evaluations, aerial image analysis, watershed modeling, and statistical analysis.

OASIS recognizes that each source assessment and delineation project has its own objectives and challenges, where each requires development of an evaluation strategy established by a multi-disciplinary look at the project problem itself. The multi-disciplinary approach facilitates a comprehensive look at the methods to collect and evaluate the data appropriately. OASIS may utilize various methods to meet the objectives of a source assessment and delineation project, which may include the following:

- ✓ Geomorphic Assessments
- ✓ Watershed assessment using GIS-based models
- ✓ Rosgen Channel Classification
- ✓ Classification of Riparian and Wetland Communities
- ✓ Custom Database Application Design and Programming
- ✓ Streambank Surveys
- ✓ Biological Assessment of Water Quality
- ✓ Remote Sensing/GIS
- ✓ Surface Water Quality Sampling and Data Analysis
- ✓ Quality Assurance/Quality Control
- ✓ Habitat Assessment
- ✓ Project-Specific Stream Assessment Methodologies
- ✓ Contaminant/Pollutant Modeling (groundwater and surface water)

Table 0.9: Staff Qualifications – TMDL Source Assessment and Delineation

Staff Name	Degree(s)	Professional Registration(s)	Professional Experience (years)	Similar Project Experience (years)	Team Role
Max Schwenne	BS-Chemical Engineering MS-Environmental Engineering		23	14	PM
John Gangemi	BS-Natural History MS-Environmental Studies		15	9	TC
Mike Cox, P.E.	BS-Geological Engineering Graduate studies-Arctic Engineering	Montana Professional Engineer, CE 16910; Alaska Professional Engineer, CE 10574;	10	6	SS
DeWitt Dominick	B.A.-Geography and Environmental Sciences M.S.-Watershed Science		9	8	SS
Susan Ives	BS-Biology		3	3	SS
Matt Blank, EIT	B.S.-Geological Engineering M.S.-Civil Engineering Ph.D. Candidate-Civil Engineering	Engineer-In-Training (EIT)	13	6	SS
Annette Sackman-Franzen	BS, Chemistry AA, Chemistry		18	8	SS

Notes: PM - Project Manager; TC – Technical Coordinator; SS – Support Staff

Table 0.10: Projects/References – TMDL Source Assessment and Delineation

Jordan Creek Historic Mining District

While working with Ecology & Environment (E&E), Annette Franzen served as the project manager for the site assessment of the Jordan Creek Historic Mining District, a 1600-square mile watershed containing thousands of historic silver mines. During this project, Ms. Franzen addressed interagency goals for completion of a Total Maximum Daily Load (TMDL) study. Sample collection, water quality measurement, Global Position System (GPS), and logbook documentation training was provided to the EPA Idaho Operations Office, United States Bureau of Land Management (BLM), Idaho Department of Lands, and Oregon and Idaho Departments of Environmental Quality so they could assist with the assessment. Project costs and analysis time were reduced by implementing x-ray fluorescence (XRF) screening analyses for 200 samples for trace metals in sediments. As a result of the onsite XRF analysis, the extent of arsenic and lead contamination within the watershed was determined, as well as the location of initial point sources (mines) and new source areas as a result of contaminant loading.

Reference Information

Company Name:	USEPA Region 10
Location of Services:	Pocatello, Idaho
Contact Person:	Monica Tonel
Telephone Number:	(206) 553-0323
Date(s) of Services:	1998 – 2000
Key Personnel:	Annette Franzen

Hydropower Dam Operations/Benthic Macroinvertebrate Study

River regulation by high-head hydroelectric dams exert profound perturbative forces on the downstream riverine environment. Wide fluctuations in daily discharge as well as changes to seasonal and annual hydrographs patterns have a direct bearing on water chemistry, distribution of benthic insects longitudinally below the dam and thus food web support of fish populations.

These influences manifest throughout the riverine zoobenthic community affecting spatial and temporal distributions, behavior, productivity, reproductive success, and many other important population variables.

Reference Information

Company Name:	Montana Fish, Wildlife and Parks
Location of Services:	Flathead and Kootenai Rivers
Contact Person:	Brian Marotz
Telephone Number:	(406) 752-5501
Date(s) of Services:	1991-92 Flathead 1994-95 Kootenai
Key Personnel:	John Gangemi

Rationale for Research below Libby and Hungry Horse Dams. In the 1980's considerable research was conducted by Stanford and Hauer on the Flathead River system and Perry on the Kootenai River examining the discharge patterns from hydroelectric dams and the resulting significant ecological impact on riverine fauna. Installation of a thermal curtain on Hungry Horse Dam in the early 1990's congruent with alterations in discharge patterns warranted further research investigating the response in the benthic community. Similarly, changes in the diel and annual discharge patterns below Libby Dam triggered in part by factors related to the interconnected electrical energy network of the Northwest Power Pool and flows designed to mitigate the losses of salmon in the Lower Columbia have also warranted further investigations to document effects on the aquatic community. Comparative analyses regarding effects of recent changes in flow regimes compared with those occurring during the studies by Stanford and Hauer on the Flathead and Perry on the Kootenai.

Objectives. The purpose of these studies were two fold: 1) to determine the effect of seasonal disruption in discharge from hydropower operations combined with installation of a selective withdrawal mechanism from the reservoir water column (Flathead only) on water quality and zoobenthos distribution of the Flathead and Kootenai Rivers, and 2) to directly compare, where possible, changes in benthic species diversity and density that may have occurred in studies undertaken in the early 1980's with conditions a decade later.

Methods. Establish five sampling sites increasing in distance longitudinally downstream from the respective dams. A sixth sample site not subjected to the discharge fluctuations or selective reservoir withdrawal was established as a reference site for each river system. Sites were sampled monthly for a 1.5 year period. Benthic macroinvertebrates were sampled in riffle areas at each site using a modified kick-net technique designed specifically for large river systems with cobble substrate. Benthic macroinvertebrate stranding resulting from wetted perimeter fluctuations in the varial zone was quantified on each monthly sampling period. Benthic macroinvertebrate drift was also measured at each site. Water quality was sampled monthly (nutrients--SRP, total P, NO2, NO3, NH4, total N, POC, DOC-- dissolved oxygen, turbidity, pH, conductivity, alkalinity). Total suspended solids (TSS) were sampled and fractionated into ecologically relevant size classifications for benthic macroinvertebrate utilization.

Effects of Global Climate Change on Aquatic Ecosystems

The distribution of aquatic organisms is highly dependent on surface water chemistry and physical factors. In mountain landscapes the chemical and physical conditions, i.e., stream discharge, temperature and water chemistry, change along an elevation gradient. Aquatic species in turn are distributed along the stream continuum paralleling the elevation gradient. Many of these species have very narrow habitat requirements. Hydrologic and thermal variation driven by climatic change may shift aquatic habitats along the elevation gradient and potentially eliminate some habitat and associated species. The pristine McDonald Creek drainage in Glacier National Park served as an excellent watershed for establishing reference sites for studying the potential effect of global climate change on aquatic species distribution and habitats.

Reference Information

Company Name:	Glacier National Park/U.S. Biological Survey
Location of Services:	Glacier National Park
Contact Person:	Dan Fagre
Telephone Number:	406-888-7922
Date(s) of Services:	1992-1996
Key Personnel:	John Gangemi

Objectives:

- Delineate the distribution and abundance of aquatic species and habitats along an elevation gradient and predict habitat shifts associated with climatic changes.
- Establish numeric standards for surface water quality reference sites along an elevation gradient.
- Quantify monthly and annual surface water discharge at reference sites along an elevation gradient.
- Predict the effect of changes in monthly and annual surface water discharge on water quality metrics and resulting shifts and potential elimination in habitat for aquatic biota.

Methods. Establish eight primary stream reference sites along elevation gradient in McDonald Creek watershed in Glacier National Park for long-term monitoring of stream discharge, water temperature, water quality parameters (nutrients--SRP, total P, NO2, NO3, NH4, total N, POC, DOC-- dissolved oxygen, turbidity, pH, conductivity, alkalinity), macrozoobenthos and periphyton. Rating curves were developed for measuring stream discharge at each respective reference site. Automatic data recorders were programmed for each site equipped with stage height and thermal sensors. Sites were sampled monthly over a four-year period. Laboratory analysis included water chemistry, chlorophyll a analysis using spectrophotometer and fluorometric techniques as well as taxonomy and enumeration of algae, zooplankton and macrozoobenthos.

Fisheries Habitat Stream Inventories, Timber Sale Evaluations, BMP Audits, 319 NPSP Assessments, Fish Habitat Improvement Projects

Assessment of fisheries habitat on Flathead National Forest streams including intensive measurement of physical habitat components, assessment of physical and biological integrity of stream community, large woody debris frequency, riffle pool ratios, fish population estimates, and coordinate sensitive fish species distribution mapping on forest.

John Gangemi was a member of an inter-disciplinary team for timber sale development. Responsible for providing data on existing aquatic habitat conditions relative to sale area, insuring compliance with numeric and narrative water quality standards, and drafting alternative actions designed to protect aquatic habitat and species.

Conducted third party audit of interagency cooperative study of Best-Management Practices (BMPs) for twenty streams on Flathead National Forest. Audit focused on evaluating BMP effectiveness associated with timber harvest, road building and agricultural practices. Audit required ability to assess natural background sediment inputs verses influx of non-point sediment sources from human caused land disturbance activities along with predictions of long-term impacts on downstream fish habitat and populations.

Reference Information

Company Name:	Flathead National Forest
Location of Services:	Flathead Cty, MT
Contact Person:	Pat VanEimeren
Telephone Number:	406-387-3800
Date(s) of Services:	1992
Key Personnel:	John Gangemi

Non-point source pollution assessments of undisturbed reference streams contrasted to disturbed study reaches allowing for delineation of natural background sediment inputs verses influx of non-point sediment sources from human caused land disturbance activities.

Plan, coordinate and implement fisheries habitat improvement projects utilizing artificial placement of large woody debris and rock structures as well as suction removal of fine sediments.

Methods used include R1/R4 fish habitat assessment, Hankin and Reeves stream inventory, Wolman Pebble Counts, McNeil sediment coring, embeddedness evaluations, mark/recapture and depletion population estimate techniques and electroshocking equipment as well as review of sensitive species distribution coupled with site specific presence-absence studies.

MT DHES Non-point source pollution (319) monitoring, identification of impaired streams and development and testing of field assessment tool

This contract was part of MT DHES initial efforts to assess NPSP and inventory impaired streams. Phase 1 consisted of development and testing of MT DHES field survey tool for assessment of non-point source pollution statewide. The NPSP field assessment survey tool was developed with MT DHES staff with input from staff at U.S. Forest Service, MT Fish, Wildlife and Parks, MT Dept. of Natural Resources, Plum Creek Timber Company and river ecologist researchers at University of Montana.

Phase 2 required deployment of MT DHES non-point source pollution assessment plan in the Flathead Basin. Twenty-six streams were evaluated for NPSP and water quality impairment. A subset of streams were located in wilderness boundaries to contrast background levels of NPSP (sediments) with study reaches disturbed by human land-use practices including timber harvest, road building, agricultural practices and urban development. BMP were applied to some of the stream reaches. This comparison allowed delineation of natural background sediment inputs verses influx of non-point sediment sources from human caused land disturbance activities. The diversity of reaches exposed to a variety of land-use practices tested and refined the applicability of the NPSP assessment tool.

Reference Information

Company Name:	Montana Dept. Health and Environmental Sciences (reorganized as MT DEQ)
Location of Services:	Flathead Cty, MT
Contact Person:	Dr. Loren Bahls
Telephone Number:	406-443-2196
Date(s) of Services:	1989
Key Personnel:	John Gangemi

This NPSP field assessment tool and regional application layed the groundwork for further development of the MT DEQ NPS program integrating TMDL approaches in 1997.

Methods. Field investigations hiking lengths of 26 streams. Photographic documentation of natural and human caused non-point source sediment loading. Demarcation on aerial photos and topographic maps. Qualitative linear estimates of land disturbance areas with overland flow linkage to perennial stream channels. Qualitative assessments of stream bank condition, fisheries habitat and LWD frequency. Documentation of point source pollution on urban streams.

Narrative report, tables, photographs, aerial photos and maps submitted to MT DHES. Open file report, MT DEQ.

TMDL Load Allocations

References

Table 0.12 provides applicable projects and references that have used and/or are using services similar to those requested by the State of Montana in the RFP. The references include State and Federal government, non-profit organizations, and private companies.

Company Profile and Experience

Please reference our general company profile presented in Section 0.

Method of Providing Services & Quality Assurance

A TMDL source assessment and delineation must be completed before load allocations may be developed. Once the watershed impairment sources have been identified, load allocations denoting a receiving water's loading capacity are developed, attributed to existing/future point/non-point pollution sources and/or natural sources. Load allocations should be developed in close collaboration with agency representatives and watershed/stakeholder groups thus that inconsistencies between similar watershed load allocations are not inadvertently developed. OASIS may utilize various methods to develop load allocations, including the following:

- ✓ Geomorphic Assessments
- ✓ Watershed assessment using GIS-based models
- ✓ Rosgen Channel Classification
- ✓ Classification of Riparian and Wetland Communities
- ✓ Streambank Surveys and Erosion Inventories
- ✓ Contaminant/Pollutant Modeling (groundwater and surface water)
- ✓ Remote Sensing/GIS
- ✓ Surface Water Quality Data Sampling and Analysis
- ✓ Quality Assurance/Quality Control
- ✓ Habitat Assessment
- ✓ Project-Specific Stream Assessment Methodologies
- ✓ Biological Sampling and Data Analysis

Table 0.11: Staff Qualifications – TMDL Load Allocations

Staff Name	Degree(s)	Professional Registration(s)	Professional Experience (years)	Similar Project Experience (years)	Team Role
Max Schwenne	BS-Chemical Engineering MS-Environmental Engineering		23	14	PM
John Gangemi	BS-Natural History MS-Environmental Studies		15	9	TC
Mike Cox, P.E.	BS-Geological Engineering Graduate studies-Arctic Engineering	Montana Professional Engineer, CE 16910; Alaska Professional Engineer, CE 10574;	10	6	SS
DeWitt Dominick	B.A.-Geography and Environmental Sciences M.S.-Watershed Science		9	8	SS
Susan Ives	BS-Biology		3	3	SS
Matt Blank, EIT	B.S.-Geological Engineering M.S.-Civil Engineering Ph.D. Candidate-Civil Engineering	Engineer-In-Training (EIT)	13	6	SS
Annette Sackman-Franzen	BS, Chemistry AA, Chemistry		18	8	SS

Notes: PM – Project Manager; TC – Technical Coordinator; SS – Support Staff

Table 0.12: Projects/References – TMDL Load Allocations

Hydropower Dam Operations/Benthic Macroinvertebrate Study

River regulation by high-head hydroelectric dams exert profound perturbative forces on the downstream riverine environment. Wide fluctuations in daily discharge as well as changes to seasonal and annual hydrographs patterns have a direct bearing on water chemistry, distribution of benthic insects longitudinally below the dam and thus food web support of fish populations.
These influences manifest throughout the riverine zoobenthic community affecting spatial and temporal distributions, behavior, productivity, reproductive success, and many other important population variables.

Reference Information

Company Name:	Montana Fish, Wildlife and Parks
Location of Services:	Flathead and Kootenai Rivers
Contact Person:	Brian Marotz
Telephone Number:	(406) 752-5501
Date(s) of Services:	1991-92 Flathead 1994-95 Kootenai
Key Personnel:	John Gangemi

Rationale for Research below Libby and Hungry Horse Dams. In the 1980's considerable research was conducted by Stanford and Hauer on the Flathead River system and Perry on the Kootenai River examining the discharge patterns from hydroelectric dams and the resulting significant ecological impact on riverine fauna. Installation of a thermal curtain on Hungry Horse Dam in the early 1990's congruent with alterations in discharge patterns warranted further research investigating the response in the benthic community. Similarly, changes in the diel and annual discharge patterns below Libby Dam triggered in part by factors related to the interconnected electrical energy network of the Northwest Power Pool and flows designed to mitigate the losses of salmon in the Lower Columbia have also warranted further investigations to document effects on the aquatic community. Comparative analyses regarding effects of recent changes in flow regimes compared with those occurring during the studies by Stanford and Hauer on the Flathead and Perry on the Kootenai.

Objectives. The purpose of these studies were two fold: 1) to determine the effect of seasonal disruption in discharge from hydropower operations combined with installation of a selective withdrawal mechanism from the reservoir water column (Flathead only) on water quality and zoobenthos distribution of the Flathead and Kootenai Rivers, and 2) to directly compare, where possible, changes in benthic species diversity and density that may have occurred in studies undertaken in the early 1980's with conditions a decade later.

Methods. Establish five sampling sites increasing in distance longitudinally downstream from the respective dams. A sixth sample site not subjected to the discharge fluctuations or selective reservoir withdrawal was established as a reference site for each river system. Sites were sampled monthly for a 1.5 year period. Benthic macroinvertebrates were sampled in riffle areas at each site using a modified kick-net technique designed specifically for large river systems with cobble substrate. Benthic macroinvertebrate stranding resulting from wetted perimeter fluctuations in the varial zone was quantified on each monthly sampling period. Benthic macroinvertebrate drift was also measured at each site. Water quality was sampled monthly (nutrients--SRP, total P, NO2, NO3, NH4, total N, POC, DOC-- dissolved oxygen, turbidity, pH, conductivity, alkalinity). Total suspended solids (TSS) were sampled and fractionated into ecologically relevant size classifications for benthic macroinvertebrate utilization.

Effects of Global Climate Change on Aquatic Ecosystems

The distribution of aquatic organisms is highly dependent on surface water chemistry and physical factors. In mountain landscapes the chemical and physical conditions, i.e., stream discharge, temperature and water chemistry, change along an elevation gradient. Aquatic species in turn are distributed along the stream continuum paralleling the elevation gradient. Many of these species have very narrow habitat requirements. Hydrologic and thermal variation driven by climatic change may shift aquatic habitats along the elevation gradient and potentially eliminate some habitat and associated species. The pristine McDonald Creek drainage in Glacier National Park served as an excellent watershed for establishing reference sites for studying the potential effect of global climate change on aquatic species distribution and habitats.
Objectives:

Reference Information

Company Name:	Glacier National Park/U.S. Biological Survey
Location of Services:	Glacier National Park
Contact Person:	Dan Fagre
Telephone Number:	406-888-7922
Date(s) of Services:	1992-1996
Key Personnel:	John Gangemi

- Delineate the distribution and abundance of aquatic species and habitats along an elevation gradient and predict habitat shifts associated with climatic changes.
- Establish numeric standards for surface water quality reference sites along an elevation gradient.
- Quantify monthly and annual surface water discharge at reference sites along an elevation gradient.
- Predict the effect of changes in monthly and annual surface water discharge on water quality metrics and resulting shifts and potential elimination in habitat for aquatic biota.

Methods. Establish eight primary stream reference sites along elevation gradient in McDonald Creek watershed in Glacier National Park for long-term monitoring of stream discharge, water temperature, water quality parameters (nutrients--SRP, total P, NO2, NO3, NH4, total N, POC, DOC-- dissolved oxygen, turbidity, pH, conductivity, alkalinity), macrozoobenthos and periphyton. Rating curves were developed for measuring stream discharge at each respective reference site. Automatic data recorders were programmed for each site equipped with stage height and thermal sensors. Sites were sampled monthly over a four-year period. Laboratory analysis included water chemistry, chlorophyll a analysis using spectrophotometer and fluorometric techniques as well as taxonomy and enumeration of algae, zooplankton and macrozoobenthos.

Fisheries Habitat Stream Inventories, Timber Sale Evaluations, BMP Audits, 319 NPSP Assessments, Fish Habitat Improvement Projects

Assessment of fisheries habitat on Flathead National Forest streams including intensive measurement of physical habitat components, assessment of physical and biological integrity of stream community, large woody debris frequency, riffle pool ratios, fish population estimates, and coordinate sensitive fish species distribution mapping on forest.

John Gangemi was a member of an inter-disciplinary team for timber sale development. Responsible for providing data on existing aquatic habitat conditions relative to sale area, insuring compliance with numeric and narrative water quality standards, and drafting alternative actions designed to protect aquatic habitat and species.

Conducted third party audit of interagency cooperative study of Best-Management Practices (BMPs) for twenty streams on Flathead National Forest. Audit focused on evaluating BMP effectiveness associated with timber harvest, road building and agricultural practices. Audit required ability to assess natural background sediment inputs verses influx of non-point sediment sources from human caused land disturbance activities along with predictions of long-term impacts on downstream fish habitat and populations.

Reference Information

Company Name:	Flathead National Forest
Location of Services:	Flathead Cty, MT
Contact Person:	Pat VanEimeren
Telephone Number:	406-387-3800
Date(s) of Services:	1992
Key Personnel:	John Gangemi

Non-point source pollution assessments of undisturbed reference streams contrasted to disturbed study reaches allowing for delineation of natural background sediment inputs verses influx of non-point sediment sources from human caused land disturbance activities.

Plan, coordinate and implement fisheries habitat improvement projects utilizing artificial placement of large woody debris and rock structures as well as suction removal of fine sediments.

Methods used include R1/R4 fish habitat assessment, Hankin and Reeves stream inventory, Wolman Pebble Counts, McNeil sediment coring, embeddedness evaluations, mark/recapture and depletion population estimate techniques and electroshocking equipment as well as review of sensitive species distribution coupled with site specific presence-absence studies.

MT DHES Non-point source pollution (319) monitoring, identification of impaired streams and development and testing of field assessment tool

This contract was part of MT DHES initial efforts to assess NPSP and inventory impaired streams. Phase 1 consisted of development and testing of MT DHES field survey tool for assessment of non-point source pollution statewide. The NPSP field assessment survey tool was developed with MT DHES staff with input from staff at U.S. Forest Service, MT Fish, Wildlife and Parks, MT Dept. of Natural Resources, Plum Creek Timber Company and river ecologist researchers at University of Montana.

Phase 2 required deployment of MT DHES non-point source pollution assessment plan in the Flathead Basin. Twenty-six streams were evaluated for NPSP and water quality impairment. A subset of streams were located in wilderness boundaries to contrast background levels of NPSP (sediments) with study reaches disturbed by human land-use practices including timber harvest, road building, agricultural practices and urban development. BMP were applied to some of the stream reaches. This comparison allowed delineation of natural background sediment inputs verses influx of non-point sediment sources from human caused land disturbance activities. The diversity of reaches exposed to a variety of land-use practices tested and refined the applicability of the NPSP assessment tool.

This NPSP field assessment tool and regional application layed the groundwork for further development of the MT DEQ NPS program integrating TMDL approaches in 1997.

Reference Information

Company Name:	Montana Dept. Health and Environmental Sciences (reorganized as MT DEQ)
Location of Services:	Flathead Cty, MT
Contact Person:	Dr. Loren Bahls
Telephone Number:	406-443-2196
Date(s) of Services:	1989
Key Personnel:	John Gangemi

Methods. Field investigations hiking lengths of 26 streams. Photographic documentation of natural and human caused non-point source sediment loading. Demarcation on aerial photos and topographic maps. Qualitative linear estimates of land disturbance areas with overland flow linkage to perennial stream channels. Qualitative assessments of stream bank condition, fisheries habitat and LWD frequency. Documentation of point source pollution on urban streams.

Narrative report, tables, photographs, aerial photos and maps submitted to MT DHES. Open file report, MT DEQ.

Jordan Creek Historic Mining District

While working with Ecology & Environment (E&E), Annette Franzen served as the project manager for the site assessment of the Jordan Creek Historic Mining District, a 1600-square mile watershed containing thousands of historic silver mines. During this project, Ms. Franzen addressed interagency goals for completion of a Total Maximum Daily Load (TMDL) study. Sample collection, water quality measurement, Global Position System (GPS), and logbook documentation training was provided to the EPA Idaho Operations Office, United States Bureau of Land Management (BLM), Idaho Department of Lands, and Oregon and Idaho Departments of Environmental Quality so they could assist with the assessment. Project costs and analysis time were reduced by implementing x-ray fluorescence (XRF) screening analyses for 200 samples for trace metals in sediments. As a result of the onsite XRF analysis, the extent of arsenic and lead contamination within the watershed was determined, as well as the location of initial point sources (mines) and new source areas as a result of contaminant loading.

Reference Information

Company Name:	USEPA Region 10
Location of Services:	Pocatello, Idaho
Contact Person:	Monica Tonel
Telephone Number:	(206) 553-0323
Date(s) of Services:	1998 – 2000
Key Personnel:	Annette Franzen

Total Maximum Daily Loads

References

Table 0.14 provides applicable projects and references that have used and/or are using services similar to those requested by the State of Montana in the RFP. The references include State and Federal government, non-profit organizations, and private companies.

Company Profile and Experience

Please reference our general company profile presented in Section 0.

Method of Providing Services & Quality Assurance

Development of Total Daily Maximum Loads (TMDLs) and subsequent TMDL plans may be completed once the targets, source assessments/delineations, and load allocations have been established. TMDL establishes the allowable loads or other water quality parameters for a specific waterbody, and determines the basis for water quality-based controls and the plans to implement them. The process of developing TMDLs must be established while giving respect to local politics, stream uses, and structural/nonstructural solutions.

The following TDML protocols apply the concepts described above, and will be used by OASIS for TMDL development projects:

- TMDLs result in maintaining and/or attaining numeric and narrative water quality standards;
- TMDLs have a quantified target or endpoint;
- TMDLs include a quantified pollutant reduction target;
- TMDLs consider all significant sources;
- TMDLs are supported by a suitable level of technical analysis;
- TMDLs contain a margin of safety and consider seasonality changes;
- TMDLs distribute responsibility (discharge source, tributaries, land parcels, etc.) for taking actions; and,
- TMDLs involve public involvement or review.

The ultimate success of a TMDL project resides in accounting for not only the science related to physical, chemical, and biological processes that may impact stream water quality, but must also be responsible to changes in the watershed over time and the existing/future influences of watershed residents. Sensitivity to stakeholder participation and interests while meeting the requirements of State and Federal standards is a delicate balancing act. OASIS recognizes that ignoring this balance can have severe economic, legal and environmental impacts. Timeliness and technical credibility of the work is key to a project's success.

Table 0.13: Staff Qualifications – Total Maximum Daily Loads

Staff Name	Degree(s)	Professional Registration(s)	Professional Experience (years)	Similar Project Experience (years)	Team Role
Max Schwenne	BS-Chemical Engineering MS-Environmental Engineering		23	14	PM
John Gangemi	BS-Natural History MS-Environmental Studies		15	9	TC
Mike Cox, P.E.	BS-Geological Engineering Graduate studies-Arctic Engineering	Montana Professional Engineer, CE 16910; Alaska Professional Engineer, CE 10574;	10	6	SS
DeWitt Dominick	B.A.-Geography and Environmental Sciences M.S.-Watershed Science		9	8	SS
Susan Ives	BS-Biology		3	3	SS
Matt Blank, EIT	B.S.-Geological Engineering M.S.-Civil Engineering Ph.D. Candidate-Civil Engineering	Engineer-In-Training (EIT)	13	6	SS
Annette Sackman-Franzen	BS, Chemistry AA, Chemistry		18	8	SS

Notes: PM - Project Manager; TC – Technical Coordinator; SS – Support Staff

Table 0.14: Projects/References – Total Maximum Daily Loads

Hydropower Dam Operations/Benthic Macroinvertebrate Study

River regulation by high-head hydroelectric dams exert profound perturbative forces on the downstream riverine environment. Wide fluctuations in daily discharge as well as changes to seasonal and annual hydrographs patterns have a direct bearing on water chemistry, distribution of benthic insects longitudinally below the dam and thus food web support of fish populations. These influences manifest throughout the riverine zoobenthic community affecting spatial and temporal distributions, behavior, productivity, reproductive success, and many other important population variables.

Reference Information

Company Name:	Montana Fish, Wildlife and Parks
Location of Services:	Flathead and Kootenai Rivers
Contact Person:	Brian Marotz
Telephone Number:	(406) 752-5501
Date(s) of Services:	1991-92 Flathead 1994-95 Kootenai
Key Personnel:	John Gangemi

Rationale for Research below Libby and Hungry Horse Dams. In the 1980's considerable research was conducted by Stanford and Hauer on the Flathead River system and Perry on the Kootenai River examining the discharge patterns from hydroelectric dams and the resulting significant ecological impact on riverine fauna. Installation of a thermal curtain on Hungry Horse Dam in the early 1990's congruent with alterations in discharge patterns warranted further research investigating the response in the benthic community. Similarly, changes in the diel and annual discharge patterns below Libby Dam triggered in part by factors related to the interconnected electrical energy network of the Northwest Power Pool and flows designed to mitigate the losses of salmon in the Lower Columbia have also warranted further investigations to document effects on the aquatic community. Comparative analyses regarding effects of recent changes in flow regimes compared with those occurring during the studies by Stanford and Hauer on the Flathead and Perry on the Kootenai.

Objectives. The purpose of these studies were two fold: 1) to determine the effect of seasonal disruption in discharge from hydropower operations combined with installation of a selective withdrawal mechanism from the reservoir water column (Flathead only) on water quality and zoobenthos distribution of the Flathead and Kootenai Rivers, and 2) to directly compare, where possible, changes in benthic species diversity and density that may have occurred in studies undertaken in the early 1980's with conditions a decade later.

Methods. Establish five sampling sites increasing in distance longitudinally downstream from the respective dams. A sixth sample site not subjected to the discharge fluctuations or selective reservoir withdrawal was established as a reference site for each river system. Sites were sampled monthly for a 1.5 year period. Benthic macroinvertebrates were sampled in riffle areas at each site using a modified kick-net technique designed specifically for large river systems with cobble substrate. Benthic macroinvertebrate stranding resulting from wetted perimeter fluctuations in the varial zone was quantified on each monthly sampling period. Benthic macroinvertebrate drift was also measured at each site. Water quality was sampled monthly (nutrients--SRP, total P, NO2, NO3, NH4, total N, POC, DOC-- dissolved oxygen, turbidity, pH, conductivity, alkalinity). Total suspended solids (TSS) were sampled and fractionated into ecologically relevant size classifications for benthic macroinvertebrate utilization.

Effects of Global Climate Change on Aquatic Ecosystems

The distribution of aquatic organisms is highly dependent on surface water chemistry and physical factors. In mountain landscapes the chemical and physical conditions, i.e., stream discharge, temperature and water chemistry, change along an elevation gradient. Aquatic species in turn are distributed along the stream continuum paralleling the elevation gradient. Many of these species have very narrow habitat requirements. Hydrologic and thermal variation driven by climatic change may shift aquatic habitats along the elevation gradient and potentially eliminate some habitat and associated species. The pristine McDonald Creek drainage in Glacier National Park served as an excellent watershed for establishing reference sites for studying the potential effect of global climate change on aquatic species distribution and habitats.

Reference Information

Company Name:	Glacier National Park/U.S. Biological Survey
Location of Services:	Glacier National Park
Contact Person:	Dan Fagre
Telephone Number:	406-888-7922
Date(s) of Services:	1992-1996
Key Personnel:	John Gangemi

Objectives:

- Delineate the distribution and abundance of aquatic species and habitats along an elevation gradient and predict habitat shifts associated with climatic changes.
- Establish numeric standards for surface water quality reference sites along an elevation gradient.
- Quantify monthly and annual surface water discharge at reference sites along an elevation gradient.
- Predict the effect of changes in monthly and annual surface water discharge on water quality metrics and resulting shifts and potential elimination in habitat for aquatic biota.

Methods. Establish eight primary stream reference sites along elevation gradient in McDonald Creek watershed in Glacier National Park for long-term monitoring of stream discharge, water temperature, water quality parameters (nutrients--SRP, total P, NO2, NO3, NH4, total N, POC, DOC-- dissolved oxygen, turbidity, pH, conductivity, alkalinity), macrozoobenthos and periphyton. Rating curves were developed for measuring stream discharge at each respective reference site. Automatic data recorders were programmed for each site equipped with stage height and thermal sensors. Sites were sampled monthly over a four-year period. Laboratory analysis included water chemistry, chlorophyll a analysis using spectrophotometer and fluorometric techniques as well as taxonomy and enumeration of algae, zooplankton and macrozoobenthos.

Fisheries Habitat Stream Inventories, Timber Sale Evaluations, BMP Audits, 319 NPSP Assessments, Fish Habitat Improvement Projects

Assessment of fisheries habitat on Flathead National Forest streams including intensive measurement of physical habitat components, assessment of physical and biological integrity of stream community, large woody debris frequency, riffle pool ratios, fish population estimates, and coordinate sensitive fish species distribution mapping on forest.

John Gangemi was a member of an inter-disciplinary team for timber sale development. Responsible for providing data on existing aquatic habitat conditions relative to sale area, insuring compliance with numeric and narrative water quality standards, and drafting alternative actions designed to protect aquatic habitat and species.

Conducted third party audit of interagency cooperative study of Best-Management Practices (BMPs) for twenty streams on Flathead National Forest. Audit focused on evaluating BMP effectiveness associated with timber harvest, road building and agricultural practices. Audit required ability to assess natural background sediment inputs verses influx of non-point sediment sources from human caused land disturbance activities along with predictions of long-term impacts on downstream fish habitat and populations.

Reference Information

Company Name:	Flathead National Forest
Location of Services:	Flathead Cty, MT
Contact Person:	Pat VanEimeren
Telephone Number:	406-387-3800
Date(s) of Services:	1992
Key Personnel:	John Gangemi

Non-point source pollution assessments of undisturbed reference streams contrasted to disturbed study reaches allowing for delineation of natural background sediment inputs verses influx of non-point sediment sources from human caused land disturbance activities.

Plan, coordinate and implement fisheries habitat improvement projects utilizing artificial placement of large woody debris and rock structures as well as suction removal of fine sediments.

Methods used include R1/R4 fish habitat assessment, Hankin and Reeves stream inventory, Wolman Pebble Counts, McNeil sediment coring, embeddedness evaluations, mark/recapture and depletion population estimate techniques and electroshocking equipment as well as review of sensitive species distribution coupled with site specific presence-absence studies.

MT DHES Non-point source pollution (319) monitoring, identification of impaired streams and development and testing of field assessment tool

This contract was part of MT DHES initial efforts to assess NPSP and inventory impaired streams. Phase 1 consisted of development and testing of MT DHES field survey tool for assessment of non-point source pollution statewide. The NPSP field assessment survey tool was developed with MT DHES staff with input from staff at U.S. Forest Service, MT Fish, Wildlife and Parks, MT Dept. of Natural Resources, Plum Creek Timber Company and river ecologist researchers at University of Montana.

Phase 2 required deployment of MT DHES non-point source pollution assessment plan in the Flathead Basin. Twenty-six streams were evaluated for NPSP and water quality impairment. A subset of streams were located in wilderness boundaries to contrast background levels of NPSP (sediments) with study reaches disturbed by human land-use practices including timber harvest, road building, agricultural practices and urban development. BMP were applied to some of the stream reaches. This comparison allowed delineation of natural background sediment inputs verses influx of non-point sediment sources from human caused land disturbance activities. The diversity of reaches exposed to a variety of land-use practices tested and refined the applicability of the NPSP assessment tool.

Reference Information

Company Name:	Montana Dept. Health and Environmental Sciences (reorganized as MT DEQ)
Location of Services:	Flathead Cty, MT
Contact Person:	Dr. Loren Bahls
Telephone Number:	406-443-2196
Date(s) of Services:	1989
Key Personnel:	John Gangemi

This NPSP field assessment tool and regional application layed the groundwork for further development of the MT DEQ NPS program integrating TMDL approaches in 1997.

Methods. Field investigations hiking lengths of 26 streams. Photographic documentation of natural and human caused non-point source sediment loading. Demarcation on aerial photos and topographic maps. Qualitative linear estimates of land disturbance areas with overland flow linkage to perennial stream channels. Qualitative assessments of stream bank condition, fisheries habitat and LWD frequency. Documentation of point source pollution on urban streams.

Narrative report, tables, photographs, aerial photos and maps submitted to MT DHES. Open file report, MT DEQ.

Stakeholder Facilitation, Collaborative Processes and Coalition Building in FERC Hydropower Proceedings

The Federal Energy Regulatory Commission oversees the process of relicensing private hydropower dams. Licenses are issued for periods of 30 to 50 years. The allocation of limited water supplies to continued power generation purposes verses instream flow for fisheries and recreation purposes makes the 5 year hydropower relicensing process highly contentious. Stakeholders with diverse interests compete for the limited water to satisfy their interests.

There are three procedures available for relicensing a hydro project: 1) The Traditional Licensing Process; 2) the Alternative Licensing Process; and 3) the Integrated Licensing Process. In addition, any of these licensing processes may evolve into a parallel Settlement Negotiation complimentary to the FERC process. Regardless of the five year licensing procedure utilized, reaching a successful outcome (translated as receipt of new 30-50 year license free of litigation) requires establishment of collaborative protocols and stakeholder facilitation to resolve complex natural resource issues.

Reference Information

Company Name:	American Whitewater
Location of Services:	National
Contact Person:	Kevin Colburn
Telephone Number:	(208) 882-2711
Date(s) of Services:	1997-2005
Key Personnel:	John Gangemi

John Gangemi is a nationally recognized expert in the FERC relicensing process having participated in over one-hundred hydropower relicense proceedings. John pioneered use of the Alternative Licensing Process and Integrated Licensing Process throughout the western United States as well as successfully negotiated licensing settlements in California, Colorado, Idaho, Montana, Oregon and Washington. John is an invited participant in hydropower relicense proceedings because of his expertise building collaborative protocols among diverse stakeholder groups as well as stakeholder facilitation skills. John played a critical role establishing ground rules and collaborative protocols for the first web-based relicense proceeding. John has provided numerous presentations on collaborative processes to agency conferences, utility conferences, environmental granting foundations and conservation groups.

In recognition of his expertise establishing collaboratives and facilitation skills the Governor of Montana appointed John to the twenty-two member River Recreation Advisory Board. The River Recreation Advisory Council developed a guidance document for managing river-based recreation in the state. The guidance document was approved by the Montana Department of Fish, Wildlife and Parks.

John has served on the steering committee of the national Hydropower Reform Coalition, a diverse group of national, regional and state river conservation groups participating in FERC hydropower license proceedings. John was a founding member of the California Hydropower Reform Coalition and chaired the Pacific Northwest Hydropower Reform Coalition. John was a founding member of the Low Impact Hydropower Institute, a coalition of national, regional and state conservation groups focused on establishing criteria and a certification process for green-energy generated from hydro projects.

Stakeholder Participation

References

Table 0.16 provides applicable projects and references that have used and/or are using services similar to those requested by the State of Montana in the RFP. The references include State and Federal government, non-profit organizations, and private companies.

Company Profile and Experience

Please reference our general company profile presented in Section 0.

Method of Providing Services & Quality Assurance

Because of the landscape scale analysis coupled with prescriptive treatments, watershed planning requires the cooperation of private landowners, business operations with an economic bottom-line as well as municipal and county governments and state and federal agencies. Leading this diverse spectrum of stakeholders that typically have conflicting and competing interests to develop and implement a successful watershed plan requires focused stakeholder facilitation and development of ground rules. Clear ground rules establish a forum for a civil dialogue where individual interests in the watershed are recognized and respected. Collaborative protocols are established clearly defining decision-making processes. Creating this collaborative forum gains trust among all stakeholders thereby increasing participation in the planning phase and ultimately treatment implementation resulting in improved water quality.

OASIS' staff have direct experience working individually with stakeholders as well as complex natural resource issues with large and diverse stakeholder interests in regulatory and legal proceedings.

OASIS may utilize various methods to facilitate stakeholder participation, which may include the following:

- ✓ Stakeholder Coordination
- ✓ Establishment of Collaboration and Consensus protocols
- ✓ Identification of Regulatory Mandates in Relation to Collaborative Decisions in Watershed Planning Process
- ✓ Facilitation of Public Meetings
- ✓ Ground Rules for Successful Public Meetings
- ✓ Public Presentations

OASIS understands the work performed under this contract can have severe economic, legal and environmental impacts. For example, a TMDL can essentially halt all development along a water body or require property owners to pay restoration costs. The results of some studies may result in enforcement action against property owners, or even local governments. Consequently, timeliness and technical credibility of the work is paramount. Some tasks may require OASIS personnel to participate in public forums as technical experts.

OASIS is presenting John Gangemi to provide significant experience and interpersonal skills working with stakeholders one-on-one and in public meetings. John has been directly involved in over one-hundred hydropower relicense proceedings. John's knowledge and expertise developing protocols for collaboratives is nationally recognized in the complex regulatory process of licensing private hydropower dams. John has attended "mutual gains" training workshops and has extensive experience developing interest based negotiations for natural resource settlements and legal proceedings. John has delivered numerous presentations to trade groups, agencies, NGOs and foundations on the necessary ingredients for establishing successful collaboratives in natural resource planning decisions. In recognition of his expertise establishing collaboratives and his facilitation skills, John has been invited to serve on state advisory boards addressing natural resource issues as well as state, regional and national coalitions comprised of diverse interests in river conservation, river recreation and hydropower generation.

Staff Qualifications

Table 0.15: Staff Qualifications – Stakeholder Participation

Staff Name	Degree(s)	Professional Registration(s)	Professional Experience (years)	Similar Project Experience (years)	Team Role
Pat Athey	BS-Botany MS-Botany		21	16	PM
Dave Trudgen	BS-Wildlife Biology & Management		28	20	TC
John Gangemi	BS-Natural History MS-Environmental Studies		15	10	SS
Russell Smith	B.A., Environmental Conservation A.A.-Building Construction		12	6	SS

Notes: PM - Project Manager; TC – Technical Coordinator; SS – Support Staff

Table 0.16: Projects/References – Stakeholder Participation

Montana Watercourse Workshops

Russell Smith has worked with the Montana Watercourse in their series of community adult education workshops. These workshops included PowerPoint presentation and tours of local wetlands and active ADC wetland restoration projects. In these, stakeholders were exposed to active wetland restoration and educational opportunities through on-the-ground walking tours. Participants typically include interested community members, as well as agency personnel, fellow consultants and practitioners.
In addition, Russell sat on Montana Watercourse's Pond Advisory Committee which was organized for the purpose of generating the publication: A Guidebook for Montana Ponds. This publication was published to help landowners make informed decisions regarding the potential benefits and negative impacts of creating an aquatic amenity.

Reference Information

Company Name:	Montana Watercourse
Location of Services:	Southwest Montana
Contact Person:	Michelle LeBeau & Karen Filipovich
Telephone Number:	(406) 994-1910
Date(s) of Services:	2003-2004
Key Personnel:	Russell Smith

Technical and Legal Services for Alaska NPDES Primacy

OASIS developed draft statutes and regulations suitable to allow the State of Alaska to assume primacy for the NPDES program. The project included the following five objectives: 1) preparation of a layperson's summary of Alaska State statutes and regulations required to comply with the requirements of the federal Clean Water Act (CWA) to assume primacy of the NPDES program; 2) preparation of draft language for the statutes and regulations Alaska will need to adopt to assume primacy of the NPDES program; 3) assistance with presentation(s) to interested stakeholders; (4) identification of technical expertise and staff training needs for implementing the NPDES program; and (5) canvassing other states for innovative permit streamlining efforts and identifying suggested statutory and regulatory language.
ADEC gave OASIS notice to proceed in the spring of 2003. All objectives were met or exceeded by OASIS. Revised drafts of the legislation and regulations were delivered to ADEC in the fall of 2003. The state is seeking primacy for the NPDES program with a goal of having a state-run program in place by July 2005.

Reference Information

Company Name:	Alaska Department of Environmental Conservation (ADEC)
Location of Services:	Anchorage, Alaska
Contact Person:	Ms. Sharon Morgan
Telephone Number:	(907) 465-5530
Date(s) of Services:	2003-2004
Key Personnel:	Max Schwenne

Stakeholder Facilitation, Collaborative Processes and Coalition Building in FERC Hydropower Proceedings

The Federal Energy Regulatory Commission oversees the process of relicensing private hydropower dams. Licenses are issued for periods of 30 to 50 years. The allocation of limited water supplies to continued power generation purposes verses instream flow for fisheries and recreation purposes makes the 5 year hydropower relicensing process highly contentious. Stakeholders with diverse interests compete for the limited water to satisfy their interests.
There are three procedures available for relicensing a hydro project: 1) The Traditional Licensing Process; 2) the Alternative Licensing Process; and 3) the Integrated Licensing Process. In addition, any of these licensing processes may evolve into a parallel Settlement Negotiation complimentary to the FERC process. Regardless of the five year licensing procedure utilized, reaching a successful outcome (translated as receipt of new 30-50 year license free of litigation) requires establishment of collaborative protocols and stakeholder facilitation to resolve complex natural resource issues.

Reference Information

Company Name:	American Whitewater
Location of Services:	National
Contact Person:	Kevin Colburn
Telephone Number:	(208) 882-2711
Date(s) of Services:	1997-2005
Key Personnel:	John Gangemi

John Gangemi is a nationally recognized expert in the FERC relicensing process having participated in over one-hundred hydropower relicense proceedings. John pioneered use of the Alternative Licensing Process and Integrated Licensing Process throughout the western United States as well as successfully negotiated licensing settlements in California, Colorado, Idaho, Montana, Oregon and Washington. John is an invited participant in hydropower relicense proceedings because of his expertise building collaborative protocols among diverse stakeholder groups as well as stakeholder facilitation skills. John played a critical role establishing ground rules and collaborative protocols for the first web-based relicense proceeding. John has provided numerous presentations on collaborative processes to agency conferences, utility conferences, environmental granting foundations and conservation groups.

In recognition of his expertise establishing collaboratives and facilitation skills the Governor of Montana appointed John to the twenty-two member River Recreation Advisory Board. The River Recreation Advisory Council developed a guidance document for managing river-based recreation in the state. The guidance document was approved by the Montana Department of Fish, Wildlife and Parks.

John has served on the steering committee of the national Hydropower Reform Coalition, a diverse group of national, regional and state river conservation groups participating in FERC hydropower license proceedings. John was a founding member of the California Hydropower Reform Coalition and chaired the Pacific Northwest Hydropower Reform Coalition. John was a founding member of the Low Impact Hydropower Institute, a coalition of national, regional and state conservation groups focused on establishing criteria and a certification process for green-energy generated from hydro projects.

Drury Gulch Site Investigation and Remedial Action

OASIS supported the USACE and their prime contractor Jacobs Engineering Group in the implementation a site investigation of the Drury Gulch former solid waste and metals dumping area, at the U.S. Coast Guard (USCG) Integrated Support Center (ISC) on Kodiak Island, Alaska. OASIS was contracted by Jacobs Engineering Group to perform a site investigation to determine if environmental media were adversely impacted by past Department of Defense activities, collect data to preliminarily evaluate potential site risk to human health and the environment, and evaluate formerly used defense site liability at Drury Gulch. OASIS performed the following tasks during the site investigation:

- Aerial photograph survey;
- Identification of ARARs;
- Surface soil sampling;
- Subsurface soil sampling using hand-auger boring advancement;
- Surface water and sediment sampling;
- Final reporting; and,
- Third-party regulatory expertise in stakeholder negotiations;

Reference Information

Company Name:	Jacobs Engineering, Inc.
Location of Services:	Kodiak, Alaska
Contact Person:	Pete Hannon
Telephone Number:	(907) 563-3322
Date(s) of Services:	1999-2001
Key Personnel:	Nathan Sande, Jeff Leety, Mike Cox

OASIS performed a longitudinal survey from aerial photographs spanning 45 years, historical site photos, and local interviews. The survey identified that Drury Gulch Creek had been rerouted by solid waste dumping activities multiple times. The survey concluded that the channelization of Drury Gulch Creek facilitated extremely rapid and consistent transport of contaminants from the solid waste deposits into an important salmonid spawning habitat. Additionally, contaminated sediments were found to be deposited upon streambanks adjacent to a local elementary school frequently used by schoolchildren during recess events.

The contaminant source delineation investigation discovered widespread polychlorinated biphenyls (PCBs) and metals (lead, chromium, arsenic, cadmium) contamination throughout the site's soils and sediments previously overlooked during previous investigations. The work at Drury Gulch was time-critical in nature due to imminent risk to human and ecological health.

Interim screening levels for the site's soils, surface water, sediments, and groundwater developed prior to the investigation were re-evaluated with respect to the many ARARs applicable to the site. The site's stakeholders included the USACE (the formerly used defense sites program representative), USCG-ISC, TSCA and RCRA components of USEPA, and the ADEC. The cleanup and institutional requirements among the various contaminated environmental media, as stipulated by the various stakeholders, complicated stakeholder agreement upon the ARARs applicable to the site. OASIS provided third-party regulatory expertise throughout negotiations between the stakeholders.

Anchorage Jet Fuel Pipeline Project

OASIS served as the Permitting Agent responsible for several major tasks:

- Environmental evaluation document similar in scope and content to a NEPA EIS for large and controversial project located along Anchorage's waterfront.
- Hazard assessment (SARA Title III) for spill scenarios of eight potential pipeline routes and existing pipeline retrofit alternatives to move fuel to the airport.
- Impact assessment of pipeline on humans and the environment.
- Public participation process including public meetings, newsletters, flyers, community council and interest group presentations.
- Mapped and evaluated jurisdictional wetlands, habitats and sensitive areas for the selected pipeline route.
- Corps 404/10, ACMP, ADFG Title 16 permit applications and agency negotiations.
- Construction-reclamation plan and compensatory mitigation plan.
- Chaired bimonthly meetings for the project work group that included agencies, special interest groups, and the public.
- Media interviews including live radio talk shows, local television stations, newspaper, and magazines.

Reference Information

Company Name:	CONAM Construction
Location of Services:	Anchorage, AK
Contact Person:	Bob Stinson
Telephone Number:	(907) 278-6600
Date(s) of Services:	1997-1999
Key Personnel:	Pat Athey

The project required development of several original documents including the Potential Construction and Operations Impact, ACMP Project Description, Corps and ADFG Permit Applications, and the Oil Spill Contingency Plan/Construction-Reclamation Plan. The project was under severe time constraints; consequently, comprehensive technical documents were produced in two or three weeks. These documents required extensive research and dozens of interviews with subject matter experts. The documents represented the most current and detailed evaluation of the mudflat environments, potential affects of an oil spill, statistical analysis, and compilation of references. OASIS has extensive experience in providing public and community relations, and routinely coordinate meeting facilities, record meeting minutes and distribute newsletters and project updates.

OASIS was able to prepare all the documentation needed to satisfy permitting requirements and address the concerns of the public, special interest groups, and resource agencies in a timely manner. The permitting was completed and the final permits were awarded on schedule. The pipeline was constructed in the fall of 1998, and OASIS continues to monitor site restoration and revegetation.

TMDL Effectiveness Monitoring

References

Table 0.18 provides applicable projects and references that have used and/or are using services similar to those requested by the State of Montana in the RFP. The references include State and Federal government, non-profit organizations, and private companies.

Company Profile and Experience

Please reference our general company profile presented in Section 0.

Method of Providing Services & Quality Assurance

Effectiveness monitoring allows for evaluation of TMDL plan effectiveness and can be used to adjust the plans to meet TMDL goals. TMDL effectiveness monitoring could include developing evaluation methods that include data collection, statistical analysis (hypothesis testing, trend evaluation), and interpretation of processes to evaluate changes over time and casual relationships for post-BMP and restoration improvements. Detailed monitoring reports will be generated to present results and provide quantitative information regarding TMDL effectiveness and improvements over time.

OASIS recognizes that evaluating TMDL effectiveness has its own objectives and challenges, where each requires development of an evaluation strategy established by a multi-disciplinary look at the project problem itself. The multi-disciplinary approach facilitates a comprehensive look at the methods to collect and evaluate the data appropriately. OASIS may utilize various methods to meet the objectives of a TMDL effectiveness monitoring program, which may include the following:

- ✓ Geomorphic Assessments
- ✓ Watershed assessment using GIS-based models
- ✓ Rosgen Channel Classification
- ✓ Classification of Riparian and Wetland Communities
- ✓ Custom Database Application Design and Programming
- ✓ Remote Sensing/GIS
- ✓ Surface Water Quality Data Analysis
- ✓ Quality Assurance/Quality Control
- ✓ Habitat Assessment
- ✓ Project-Specific Stream Assessment Methodologies

Table 0.17: Staff Qualifications – TMDL Effectiveness Montoring

Staff Name	Degree(s)	Professional Registration(s)	Professional Experience (years)	Similar Project Experience (years)	Team Role
Max Schwenne	BS-Chemical Engineering MS-Environmental Engineering		23	14	PM
John Gangemi	BS-Natural History MS-Environmental Studies		15	9	TC
Mike Cox, P.E.	BS-Geological Engineering Graduate studies-Arctic Engineering	Montana Professional Engineer, CE 16910; Alaska Professional Engineer, CE 10574;	10	6	SS
DeWitt Dominick	B.A.-Geography and Environmental Sciences M.S.-Watershed Science		9	8	SS
Susan Ives	BS-Biology		3	3	SS
Matt Blank, EIT	B.S.-Geological Engineering M.S.-Civil Engineering Ph.D. Candidate-Civil Engineering	Engineer-In-Training (EIT)	13	6	SS
Annette Sackman-Franzen	BS, Chemistry AA, Chemistry		18	8	SS

Notes: PM - Project Manager; TC – Technical Coordinator; SS – Support Staff

Table 0.18: Projects/References – TMDL Effectiveness Monitoring

Watershed Study of Culvert Impacts to Fish Populations

Mr. Blank performed a research project for a fish passage study performed by Montana State University for a project funded by the Montana Department of Transportation. The project focused on assessing how culverts were influencing fish populations across a large drainage basin in Montana. The Clearwater river drainage was selected as the project drainage because it has a large number of culvert crossings, populations of bull and westslope cutthroat trout, and a range of land ownership. All culverts above Seeley Lake were visited, and 47 culverts were selected for data collection and analysis. The field effort included hydrologic, hydraulic, geomorphologic, habitat, and biological data collection. Statistical analyses were performed including several statistical methods: Mann-Whitney tests, Wilcoxon paired-sample tests, Shapiro-Wilk tests for normality, Chi-squared tests and both simple and multiple regression analyses. Geomorphologic and habitat data were collected following procedures outlined in USFS R1/R4 and following Rosgen channel classification. Electrofishing was performed at 20 sites for comparison of fish populations above and below culverts. In addition, a direct fish passage method was developed and used to provide a more active means of assessing passage through culverts. The final report is available on-line at: http://www.mdt.state.mt.us/research/docs/research_proj/fish_passage/final_report.pdf.

Reference Information

Company Name:	Montana State University and Montana Department of Transportation
Location of Services:	Clearwater River Drainage, Seeley Lake, Montana and Mulherin Creek, Montana
Contact Person:	Dr. Joel Cahoon
Telephone Number:	(406) 994-5961
Date(s) of Services:	2002 through present
Key Personnel:	Matt Blank

A second fish passage study is presently underway at Mulherin Creek near Gardiner Montana. This study is focused on passage during high flow. Mulherin creek has both resident and migratory populations of rainbow and Yellowstone cutthroat trout. The field effort includes detailed velocity mapping with 1-D and 3-D velocity meters, use of gaging stations for continuous flow monitoring and biological sampling. Fish traps and PIT tags with antennae readers placed above and below culverts are used to provide fish movement and passage data. Data analysis includes detailed fluid modeling using state of the art computational fluid dynamic (CFD) techniques.

Hydraulic/Geomorphologic Parameter Comparison - Resurrection Creek, Alaska

Matt Blank performed a river study of Resurrection Creek near Hope, Alaska. Portions of Resurrection creek had been severely impacted by almost 100 years of hydraulic mining activities. The project involved a hydraulic and geomorphologic trend analysis to evaluate mining impacts using a combination of field data collection, historic aerial photo analysis and hydraulic modeling. The study used comparisons between reference reaches and reaches disturbed by mining activity. Work tasks included establishment of 48 transects over seven miles of river. A water surface profile model of seven miles of stream was constructed using HEC-RAS. The project included detailed calibration and validation of the model with several field data sets. This model was used to compare how different flow events may or may not access the floodplain in the reference reach versus the mined reaches. A 1-mile channel reconstruction project is presently underway on Resurrection Creek.

Reference Information

Company Name:	Chugach National Forest; Seward Ranger District
Location of Services:	Hope, Alaska
Contact Person:	Eric Johansen
Telephone Number:	(907) 224-3374
Date(s) of Services:	2001 to 2002
Key Personnel:	Matt Blank

Hydropower Dam Operations/Benthic Macroinvertebrate Study

Reference Information

Company Name:	Montana Fish, Wildlife and Parks
Location of Services:	Flathead and Kootenai Rivers
Contact Person:	Brian Marotz
Telephone Number:	(406) 752-5501
Date(s) of Services:	1991-92 Flathead 1994-95 Kootenai
Key Personnel:	John Gangemi

River regulation by high-head hydroelectric dams exert profound perturbative forces on the downstream riverine environment. Wide fluctuations in daily discharge as well as changes to seasonal and annual hydrographs patterns have a direct bearing on water chemistry, distribution of benthic insects longitudinally below the dam and thus food web support of fish populations.

These influences manifest throughout the riverine zoobenthic community affecting spatial and temporal distributions, behavior, productivity, reproductive success, and many other important population variables.

Rationale for Research below Libby and Hungry Horse Dams. In the 1980's considerable research was conducted by Stanford and Hauer on the Flathead River system and Perry on the Kootenai River examining the discharge patterns from hydroelectric dams and the resulting significant ecological impact on riverine fauna. Installation of a thermal curtain on Hungry Horse Dam in the early 1990's congruent with alterations in discharge patterns warranted further research investigating the response in the benthic community. Similarly, changes in the diel and annual discharge patterns below Libby Dam triggered in part by factors related to the interconnected electrical energy network of the Northwest Power Pool and flows designed to mitigate the losses of salmon in the Lower Columbia have also warranted further investigations to document effects on the aquatic community. Comparative analyses regarding effects of recent changes in flow regimes compared with those occurring during the studies by Stanford and Hauer on the Flathead and Perry on the Kootenai.

Objectives. The purpose of these studies were two fold: 1) to determine the effect of seasonal disruption in discharge from hydropower operations combined with installation of a selective withdrawal mechanism from the reservoir water column (Flathead only) on water quality and zoobenthos distribution of the Flathead and Kootenai Rivers, and 2) to directly compare, where possible, changes in benthic species diversity and density that may have occurred in studies undertaken in the early 1980's with conditions a decade later.

Methods. Establish five sampling sites increasing in distance longitudinally downstream from the respective dams. A sixth sample site not subjected to the discharge fluctuations or selective reservoir withdrawal was established as a reference site for each river system. Sites were sampled monthly for a 1.5 year period. Benthic macroinvertebrates were sampled in riffle areas at each site using a modified kick-net technique designed specifically for large river systems with cobble substrate. Benthic macroinvertebrate stranding resulting from wetted perimeter fluctuations in the varial zone was quantified on each monthly sampling period. Benthic macroinvertebrate drift was also measured at each site. Water quality was sampled monthly (nutrients--SRP, total P, NO2, NO3, NH4, total N, POC, DOC-- dissolved oxygen, turbidity, pH, conductivity, alkalinity). Total suspended solids (TSS) were sampled and fractionated into ecologically relevant size classifications for benthic macroinvertebrate utilization.

Effects of Global Climate Change on Aquatic Ecosystems

Reference Information

Company Name:	Glacier National Park/U.S. Biological Survey
Location of Services:	Glacier National Park
Contact Person:	Dan Fagre
Telephone Number:	406-888-7922
Date(s) of Services:	1992-1996
Key Personnel:	John Gangemi

The distribution of aquatic organisms is highly dependent on surface water chemistry and physical factors. In mountain landscapes the chemical and physical conditions, i.e., stream discharge, temperature and water chemistry, change along an elevation gradient. Aquatic species in turn are distributed along the stream continuum paralleling the elevation gradient. Many of these species have very narrow habitat requirements. Hydrologic and thermal variation driven by climatic change may shift aquatic habitats along the elevation gradient and potentially eliminate some habitat and associated species. The pristine McDonald Creek drainage in Glacier National Park served as an excellent watershed for establishing reference sites for studying the potential effect of global climate change on aquatic species distribution and habitats.

Objectives:

- Delineate the distribution and abundance of aquatic species and habitats along an elevation gradient and predict habitat shifts associated with climatic changes.
- Establish numeric standards for surface water quality reference sites along an elevation gradient.
- Quantify monthly and annual surface water discharge at reference sites along an elevation gradient.
- Predict the effect of changes in monthly and annual surface water discharge on water quality metrics and resulting shifts and potential elimination in habitat for aquatic biota.

Methods. Establish eight primary stream reference sites along elevation gradient in McDonald Creek watershed in Glacier National Park for long-term monitoring of stream discharge, water temperature, water quality parameters (nutrients--SRP, total P, NO2, NO3, NH4, total N, POC, DOC-- dissolved oxygen, turbidity, pH, conductivity, alkalinity), macrozoobenthos and periphyton. Rating curves were developed for measuring stream discharge at each respective reference site. Automatic data recorders were programmed for each site equipped with stage height and thermal sensors. Sites were sampled monthly over a four-year period. Laboratory analysis included water chemistry, chlorophyll a analysis using spectrophotometer and fluorometric techniques as well as taxonomy and enumeration of algae, zooplankton and macrozoobenthos.

Fisheries Habitat Stream Inventories, Timber Sale Evaluations, BMP Audits, 319 NPSP Assessments, Fish Habitat Improvement Projects

Assessment of fisheries habitat on Flathead National Forest streams including intensive measurement of physical habitat components, assessment of physical and biological integrity of stream community, large woody debris frequency, riffle pool ratios, fish population estimates, and coordinate sensitive fish species distribution mapping on forest.

John Gangemi was a member of an inter-disciplinary team for timber sale development. Responsible for providing data on existing aquatic habitat conditions relative to sale area, insuring compliance with numeric and narrative water quality standards, and drafting alternative actions designed to protect aquatic habitat and species.

Conducted third party audit of interagency cooperative study of Best-Management Practices (BMPs) for twenty streams on Flathead National Forest. Audit focused on evaluating BMP effectiveness associated with timber harvest, road building and agricultural practices. Audit required ability to assess natural background sediment inputs verses influx of non-point sediment sources from human caused land disturbance activities along with predictions of long-term impacts on downstream fish habitat and populations.

Reference Information

Company Name:	Flathead National Forest
Location of Services:	Flathead Cty, MT
Contact Person:	Pat VanEimeren
Telephone Number:	406-387-3800
Date(s) of Services:	1992
Key Personnel:	John Gangemi

Non-point source pollution assessments of undisturbed reference streams contrasted to disturbed study reaches allowing for delineation of natural background sediment inputs verses influx of non-point sediment sources from human caused land disturbance activities.

Plan, coordinate and implement fisheries habitat improvement projects utilizing artificial placement of large woody debris and rock structures as well as suction removal of fine sediments.

Methods used include R1/R4 fish habitat assessment, Hankin and Reeves stream inventory, Wolman Pebble Counts, McNeil sediment coring, embeddedness evaluations, mark/recapture and depletion population estimate techniques and electroshocking equipment as well as review of sensitive species distribution coupled with site specific presence-absence studies.

MT DHES Non-point source pollution (319) monitoring, identification of impaired streams and development and testing of field assessment tool

This contract was part of MT DHES initial efforts to assess NPSP and inventory impaired streams. Phase 1 consisted of development and testing of MT DHES field survey tool for assessment of non-point source pollution statewide. The NPSP field assessment survey tool was developed with MT DHES staff with input from staff at U.S. Forest Service, MT Fish, Wildlife and Parks, MT Dept. of Natural Resources, Plum Creek Timber Company and river ecologist researchers at University of Montana.

Phase 2 required deployment of MT DHES non-point source pollution assessment plan in the Flathead Basin. Twenty-six streams were evaluated for NPSP and water quality impairment. A subset of streams were located in wilderness boundaries to contrast background levels of NPSP (sediments) with study reaches disturbed by human land-use practices including timber harvest, road building, agricultural practices and urban development. BMP were applied to some of the stream reaches. This comparison allowed delineation of natural background sediment inputs verses influx of non-point sediment sources from human caused land disturbance activities. The diversity of reaches exposed to a variety of land-use practices tested and refined the applicability of the NPSP assessment tool.

This NPSP field assessment tool and regional application layed the groundwork for further development of the MT DEQ NPS program integrating TMDL approaches in 1997.

Reference Information

Company Name:	Montana Dept. Health and Environmental Sciences (reorganized as MT DEQ)
Location of Services:	Flathead Cty, MT
Contact Person:	Dr. Loren Bahls
Telephone Number:	406-443-2196
Date(s) of Services:	1989
Key Personnel:	John Gangemi

Methods. Field investigations hiking lengths of 26 streams. Photographic documentation of natural and human caused non-point source sediment loading. Demarcation on aerial photos and topographic maps. Qualitative linear estimates of land disturbance areas with overland flow linkage to perennial stream channels. Qualitative assessments of stream bank condition, fisheries habitat and LWD frequency. Documentation of point source pollution on urban streams.

Narrative report, tables, photographs, aerial photos and maps submitted to MT DHES. Open file report, MT DEQ.

Remote Sensing

References

Table 0.20 provides applicable projects and references that have used and/or are using services similar to those requested by the State of Montana in the RFP. The references include State and Federal government, non-profit organizations, and private companies.

Company Profile and Experience

Please reference our general company profile presented in Section 0.

Method of Providing Services & Quality Assurance

Remote Sensing allows for initial retrieval of data from large areas without the expense of having to send personnel to complete extensive field investigations. Data sources such as aerial/satellite imagery are readily available and also allow for longitudinal investigations to explore historic land and water configurations for periods up to 50 years ago. OASIS has significant experience in the use of photo interpretation to evaluate historical land use, vegetation, erosion, forest cover, and stream channel conditions. OASIS maintains a collection of cutting edge computer hardware and software to facilitate use of the latest remote sensing technologies, and is committed to keeping our IT capabilities up-to-date.

Remote Sensing technology and capabilities have had significant improvements in recent years. Scaled high-resolution 3-D imagery using USGS Digital Elevation Models (DEM) and Digital Orthophoto Quadrangles (DOQ) previously requiring timely purchases and downloads are now available in numerous online formats for quick preview and selection. One example is NASA's WorldWind software, which includes LandSat 7 images and USGS 1-meter resolution DOQs integrated with USGS DEMs. These images coupled with NASA's Shuttle Radar Topography Mission (SRTM) data allows users to position themselves anywhere in the U.S. as if they were flying above or within a watershed drainage with either LandSat, USGS DOQs, or USGS Topographic Raster Map images displayed as the viewed land surface. These 3D images are now being offered with vertical contour interval resolutions of 100' or less. Images may be loaded into GIS and CAD software from the program cache, with latitude/longitude precision of 10^{-13} degrees, allowing precise locations and reaches to be viewed with little data intervention and manipulation. OASIS has explored utilization of this highly powerful and inexpensive software in GIS applications for recent remote sensing projects, using AutoCAD, MrSID, and ArcGIS software to enhance remote assessment techniques.

OASIS uses remote sensing techniques to gather understandings of vegetation/ground cover characteristics, stream bank locations, visible erosion areas, stream channel trends, and historical land use. OASIS may utilize various methodologies with remote sensing sources, including the following:

- ✓ Aerial Photo Interpretation
- ✓ Calculation of Indicator Parameters
- ✓ Multispectral Image Interpretation
- ✓ Hyperspectral Image Interpretation
- ✓ Custom Database Application Design and Programming
- ✓ NHD Dataset Integration
- ✓ Longitudinal Studies
- ✓ Habitat Assessment

Table 0.19: Staff Qualifications – Remote Sensing

Staff Name	Degree(s)	Professional Registration(s)	Professional Experience (years)	Similar Project Experience (years)	Team Role
Tom Coleman	B.S.-Civil Engineering M.S.-Environmental Engineering		11	8	PM
DeWitt Dominick	B.A.-Geography and Environmental Sciences M.S.-Watershed Science		9	8	TC
Matt Blank, EIT	B.S.-Geological Engineering M.S.-Civil Engineering Ph.D. Candidate-Civil Engineering	Engineer-In-Training (EIT)	13	5	SS
Drake Burford	B.S.-Geohydrology M.S. Fish & Wildlife Management		7	4	SS
Russell Smith	B.A., Environmental Conservation A.A.-Building Construction		12	6	SS
Jeannette Romig	B.S.-General Science M.S.-Earth Science		6	2	SS

Notes: PM - Project Manager; TC – Technical Coordinator; SS – Support Staff

Table 0.20: Projects/References – Remote Sensing

Hydraulic/Geomorphologic Parameter Comparison - Resurrection Creek, Alaska

Matt Blank performed a river study of Resurrection Creek near Hope, Alaska. Portions of Resurrection creek had been severely impacted by almost 100 years of hydraulic mining activities. The project involved a hydraulic and geomorphologic trend analysis to evaluate mining impacts using a combination of field data collection, historic aerial photo analysis and hydraulic modeling. The study used comparisons between reference reaches and reaches disturbed by mining activity. Work tasks included establishment of 48 transects over seven miles of river. A water surface profile model of seven miles of stream was constructed using HEC-RAS. The project included detailed calibration and validation of the model with several field data sets. This model was used to compare how different flow events may or may not access the floodplain in the reference reach versus the mined reaches. A 1-mile channel reconstruction project is presently underway on Resurrection Creek.

Reference Information

Company Name:	Chugach National Forest; Seward Ranger District
Location of Services:	Hope, Alaska
Contact Person:	Eric Johansen
Telephone Number:	(907) 224-3374
Date(s) of Services:	2001 to 2002
Key Personnel:	Matt Blank

Jack Creek Ranch & Woodson Creek Wetland Mitigation Projects

The purpose of these large-scale wetland/stream mitigation projects was to provide the Montana Department of Transportation (MDT) with credits to offset wetland impacts from highway construction activities in Madison and Meagher counties. The work on Jack Creek Ranch revolved around restoring and enhancing over 9,300 feet of fluvial fish habitat, restoring the channel's hydraulic efficiency, and restoring approximately 80 acres of adjacent scrub/shrub and emergent wetlands. This project was successfully completed in 2004. Project objectives for the Woodson Creek mitigation include restoring over 10,000 feet of Woodson Creek channel, restoring the channel's hydraulic efficiency, reconnecting the creek to its historic floodplain, and restoring/enhancing over 40 acres of emergent wetlands. This project is currently in the design phase with construction expected to being summer 2005.

One-meter resolution historical aerial photos from the 1950s through1997 were used during the wetland delineation for both projects to understand how the hydrology and vegetation has changed over time. Wetland and upland community boundaries were estimated from the photographs where possible and ground-truthed in the field. This information was also used to estimate the number of wetland acres that could be restored and serve as credits for MDT.

Reference Information

Company Name:	Jack Creek Ranch & Ringling Land and Cattle Co. & MDT
Location of Services:	Jeffers, MT & Ringling, MT
Contact Person:	Larry Urban MDT Wetland Specialist
Telephone Number:	(406) 444-6224
Date(s) of Services:	2003 – present
Key Personnel:	Tom Coleman Russell Smith DeWitt Dominick Jeannette Romig

The design for the wetland portion of the restoration projects focused on returning wetland hydrology to drained wetlands in the vicinity of extensive drainage ditch systems. Aerial photographs were used to estimate the volume of fill required to disable the systems. The elimination of the ditch system on the Jack Creek Ranch has allowed subsurface and surface hydrology to return and influence the vegetative community of the field. This is also expected to occur at the Woodson Creek mitigation site.

Aerial photos were used extensively to assess each project area's' watershed characteristics, stream geomorphology and floodplain extent. Active channel width, sinuosity, channel type, and flood plain width of the historic channels were determined from historic aerial photographs and field data. Based on photo interpretation and channel bed and bank materials collected from upstream reference reaches, the target channel cross section for both streams is comparable to an E5 channel under the Rosgen Classification System. The new channel at each site was designed to follow the old meander footprint within the historic floodplain. The basic channel section is then refined through hydraulic analysis using HEC-RAS water surface profile software.

Dana/Nelson Spring Creek Restoration

This project will return three fragmented spring creeks to their historic channel configuration. Benefits include increased spawning habitat for Yellowstone cutthroat trout, increased waterfowl habitat, point source pollution control and sediment containment, increase woody vegetation on valley floor and increased water flows.

ADC is using a natural channel design approach for restoring and constructing the new stream channel. This approach considers a variety of data including historic aerial photos, study of similar stream types, and hydraulic analysis. The stated land use goals are also considered to accomplish a restoration design that maximizes these benefits.

Remote sensing, in the form of 1-meter resolution historic aerial photographs was an integral part of the data collection phase of this project. Riparian corridor fragmentation is evident where the spring flows are routed through several channels that have been largely altered from their historic condition. In addition several ditches that have been excavated perpendicular to the valley fall line bisect the site. These ditches were presumably excavated to route spring flows and likely to lower the groundwater table making the land more suitable as pasture ground. The aerial photographs were used to estimate the volume of fill required to disable the ditches. Early aerials suggest the entire site likely consisted of a patchwork of emergent wetlands corresponding to deposits of fine-grained soil in ancient river meanders. Presently, the spring flows are split and only converge for the last 500 feet of channel.

Reference Information

Company Name:	Andy Dana
Location of Services:	Park County, MT
Contact Person:	Andy Dana
Telephone Number:	(406) 586-9270
Date(s) of Services:	Spring 2005 – Present
Key Personnel:	Tom Coleman DeWitt Dominick

Old meander scrolls along the historic course of the spring creek channel are also evident in historic aerial photos and suggest a stream that was far more sinuous than the current channel. The restoration design will increase the stream length on the order of 50% by re-establishing a more sinuous plan form. Creation of appropriate channel geometry for sediment conveyance allows for construction of a more sinuous channel pattern, maximizing total channel length, and the quantity and complexity of physical fish habitat.

Cloud Ranch Stream/Wetland Mitigation

Cloud Ranch contains a one-mile reach of Big Timber Creek, which was severely disturbed during the 1990's. After a rare fall flood, the previous owner used a bulldozer to modify the channel in an apparent attempt to mitigate future flood impacts. The modifications resulted in a straightened and widened channel. Channel bed materials were used to create dikes along much of the left bank margin. The alterations to the natural channel and floodplain caused accelerated degradation and impairment to the surrounding riparian wetland and floodplain habitat.

ADC was retained by the Cloud Ranch to develop a stream and floodplain restoration plan for the impacted reach of Big Timber Creek. Historical aerial photographs were examined to determine the pre-impact condition of the channel. Active channel width, channel type, and average flood plain width of the pre-impacted channel was estimated from the aerial photos and ground truthed in the field to develop the restored channel design. The channelized segment of the creek was restored to a meandering channel pattern, and associated gravel point bars were densely vegetated with willows and cottonwood plantings. The artificial dikes were removed, allowing the floodwaters to spread out, re-connecting the channel to floodplain. Likewise, a large portion of a marginal shallow pond was deepened and water draining the pond was designed to support an extensive sedge wetlands meadow. As a result of these restoration efforts, 5.5 acres of riparian and emergent wetland were restored on the bottomland of Big Timber Creek.

Reference Information

Company Name:	Cloud Ranch & MDT
Location of Services:	Big Timber, MT
Contact Person:	Larry Urban, MDT Tom Hintz, FWP
Telephone Number:	Larry Urban, (406) 444-6224 Tom Hintz, (406) 994-7889
Date(s) of Services:	2001
Key Personnel:	Tom Coleman Russell Smith Jeannette Romig Max Hjortsberg

its

Wetland banking credits were accepted by and sold to Montana Department of Transportation (MDT). These funds paid for a large portion of this project, resulting in increased natural resource value.

Drury Gulch Site Investigation and Remedial Action

OASIS supported the USACE and their prime contractor Jacobs Engineering Group in the implementation a site investigation of the Drury Gulch former solid waste and metals dumping area, at the U.S. Coast Guard (USCG) Integrated Support Center (ISC) on Kodiak Island, Alaska. OASIS was contracted by Jacobs Engineering Group to perform a site investigation to determine if environmental media were adversely impacted by past Department of Defense activities, collect data to preliminarily evaluate potential site risk to human health and the environment, and evaluate formerly used defense site liability at Drury Gulch. OASIS performed the following tasks during the site investigation:

- Aerial photograph survey;
- Identification of ARARs;
- Surface soil sampling;
- Subsurface soil sampling using hand-auger boring advancement;
- Surface water and sediment sampling;
- Final reporting; and,
- Third-party regulatory expertise in stakeholder negotiations;

Reference Information

Company Name:	Jacobs Engineering, Inc.
Location of Services:	Kodiak, Alaska
Contact Person:	Pete Hannon
Telephone Number:	(907) 563-3322
Date(s) of Services:	1999-2001
Key Personnel:	Nathan Sande, Jeff Leety, Mike Cox

OASIS performed a longitudinal survey from aerial photographs spanning 45 years, historical site photos, and local interviews. The survey identified that Drury Gulch Creek had been rerouted by solid waste dumping activities multiple times. The survey concluded that the channelization of Drury Gulch Creek facilitated extremely rapid and consistent transport of contaminants from the solid waste deposits into an important salmonid spawning habitat. Additionally, contaminated sediments were found to be deposited upon streambanks adjacent to a local elementary school frequently used by schoolchildren during recess events.

The contaminant source delineation investigation discovered widespread polychlorinated biphenyls (PCBs) and metals (lead, chromium, arsenic, cadmium) contamination throughout the site's soils and sediments previously overlooked during previous investigations. The work at Drury Gulch was time-critical in nature due to imminent risk to human and ecological health.

Interim screening levels for the site's soils, surface water, sediments, and groundwater developed prior to the investigation were re-evaluated with respect to the many ARARs applicable to the site. The site's stakeholders included the USACE (the formerly used defense sites program representative), USCG-ISC, TSCA and RCRA components of USEPA, and the ADEC. The cleanup and institutional requirements among the various contaminated environmental media, as stipulated by the various stakeholders, complicated stakeholder agreement upon the ARARs applicable to the site. OASIS provided third-party regulatory expertise throughout negotiations between the stakeholders.

Statistical Analysis

References

Table 0.22 provides applicable projects and references that have used and/or are using services similar to those requested by the State of Montana in the RFP. The references include State and Federal government, non-profit organizations, and private companies.

Company Profile and Experience

Please reference our general company profile presented in Section 0.

Method of Providing Services & Quality Assurance

OASIS applies statistical analysis congruent with client/project needs. Descriptive statistics coupled with graphic representation provide a basic snapshot of data trends and relationships between variables. More robust statistical analysis enables OASIS staff to understand influence of multiple independent variables across temporal and spatial scales. More importantly, OASIS study design and sample frequency is driven by the statistical tools appropriate for a given project. OASIS commonly utilizes Microsoft Access and Micorosft SQL Server 2000 to build database structures for data analysis. Microsoft Excel and SPSS (if required) are used for querying, summarizing, and statistically analyzing data. Typical statistical methods utilized by OASIS include the following:

- ✓ Design of Statistically Appropriate Studies
- ✓ Trend Analysis
- ✓ Nonparametric Methods
- ✓ Regression Analysis
- ✓ Multivariate Analysis
- ✓ Descriptive Statistics/Graphics

Staff Qualifications

Table 0.21: Staff Qualifications – Statistical Analysis

Staff Name	Degree(s)	Professional Registration(s)	Professional Experience (years)	Similar Project Experience (years)	Team Role
Max Schwenne	BS-Chemical Engineering MS-Environmental Engineering		23	17	PM
Matt Blank, EIT	B.S.-Geological Engineering M.S.-Civil Engineering Ph.D. Candidate-Civil Engineering	Engineer-In-Training (EIT)	13	6	TC
Eppie Havel	BS-Environmental Studies MS-Environmental Quality Science		11	7	SS
Nathan Sande	BS-Sociology/Natural Science MS-Environmental Science		11	7	SS
Jeannette Romig	B.S.-General Science M.S.-Earth Science		6	3	SS
Susan Ives	BS-Biology		3	2	SS

Notes: PM - Project Manager; TC – Technical Coordinator; SS – Support Staff

Table 0.22: Projects/References – Statistical Analysis

Watershed Study of Culvert Impacts to Fish Populations

Mr. Blank and Mr. Burford were research partners for a fish passage study performed by Montana State University for a project funded by the Montana Department of Transportation. The project focused on assessing how culverts were influencing fish populations across a large drainage basin in Montana. The Clearwater river drainage was selected as the project drainage because it has a large number of culvert crossings, populations of bull and westslope cutthroat trout, and a range of land ownership. All culverts above Seeley Lake were visited, and 47 culverts were selected for data collection and analysis. The field effort included hydrologic, hydraulic, geomorphologic, habitat, and biological data collection. Statistical analyses were performed including several statistical methods: Mann-Whitney tests, Wilcoxon paired-sample tests, Shapiro-Wilk tests for normality, Chi-squared tests and both simple and multiple regression analyses. Geomorphologic and habitat data were collected following procedures outlined in USFS R1/R4 and following Rosgen channel classification. Electrofishing was performed at 20 sites for comparison of fish populations above and below culverts. In addition, a direct fish passage method was developed and used to provide a more active means of assessing passage through culverts. The final report is available on-line at: http://www.mdt.state.mt.us/research/docs/research_proj/fish_passage/final_report.pdf.

Reference Information

Company Name:	Montana State University and Montana Department of Transportation
Location of Services:	Clearwater River Drainage, Seeley Lake, Montana
Contact Person:	Dr. Joel Cahoon
Telephone Number:	(406) 994-5961
Date(s) of Services:	2002 to 2004
Key Personnel:	Matt Blank, Drake Burford

Mr. Blank has taken a number of statistic courses to support his work during his Masters and PhD program. These courses covered hypothesis testing and estimation; classification and presentation of data; descriptive statistics; transformation and dummy variables; variable selection; one-way, two-way and higher-way ANOVA; interaction, fixed, random and mixed effects. In addition, Mr. Blank developed models as part of course work using the following advanced statistic procedures: multiple linear regression, binomial logistic regression, poisson, zero-inflated, negative binomial, zero-inflated negative binomial, binomial logit, multinomial logit, ordered probit and duration models.

Greater Prudhoe Bay Baseline Lake Water Study

The baseline water quality conditions of 79 lakes in the Greater Prudhoe Bay (GPB) area of Alaska's North Slope were evaluated by sampling and analyzing a suite of 41 parameters in August 2003. The parameter suite included dissolved and total metals, anions, conductivity, dissolved oxygen, oxidation-reduction potential (ORP), pH, temperature, color, diesel range organics, dissolved organic carbon and alkalinity. In addition to documenting the natural water quality conditions of these lakes, this study evaluated potential differences in water quality due to geographic location and lake size. Forty-nine (49) of the lakes are located in the Prudhoe Bay Unit (PBU) outside of the Sagavanirktok (Sag) River Delta, fifteen of the lakes are located in the Sag River Delta and five lakes are located east of the PBU and the Sag River Delta. Five large lakes (>2000 feet diameter along the main axis) and five small lakes (<30 feet diameter along the main axis) were evaluated. These large and small lakes were selected in close proximity to a medium lake (200-1000 feet diameter along the main axis) to reduce variability due to location.

Reference Information

Company Name:	BP Exploration, Alaska, Inc.
Location of Services:	Prudhoe Bay, AK
Contact Person:	Jim Chatham
Telephone Number:	(907) 564-4554
Date(s) of Services:	2004
Key Personnel:	Max Schwenne Sue Ives

Statistical analysis was performed on four groups of data: five small lakes, five large lakes, 69 medium lakes and the entire dataset of 79 lakes. Summary statistics include mean, standard deviation, maximum, minimum, median, coefficient of variation, upper confidence limit and upper tolerance limit. Multivariate factor analysis was applied to the dataset to attribute commonalities between parameters to factors.

The results of this study demonstrate that the natural water quality of certain lakes in the GPB area would not meet Alaska Water Quality Standards (AWQS). Tolerance limits were used to compare parameters with their respective AWQS. The parameters that would not attain the AWQS include nitrates, dissolved aluminum, dissolved iron, dissolved lead, dissolved manganese, dissolved zinc, total aluminum, total iron, total lead, total manganese, total zinc, pH, alkalinity and color. In general, small lakes have higher concentrations than the medium or large lakes for many of the parameters. All parameters except for nitrates would not meet the AWQS for the small lakes. Eight parameters would not meet the AWQS for the entire dataset.

All statstical baseline results and study information was loaded into ArcGIS 9.0 for presentation using a geographic mapping interface.

3-D Modeling of Flow in Culverts using Computational Fluid Dynamics (CFD)

Mr. Blank is presently constructing three dimensional flow models of water flow through culverts using computational fluid dynamic principles (CFD). The models are developed using CFX, a fluid solver within ANSYS. These models are calibrated and validated against large velocity and water surface data sets. The data sets are collected using an Acoustic Doppler Velocimeter (ADV) that collects three dimensional point velocity data at 75 samples per second. The field effort has generated millions of data points to date. As part of this project, Mr. Blank has written programs in visual basic and Matlab to manage, simplify and reduce the large volumes of field data collected.

Reference Information

Company Name:	Montana State University and Montana Department of Transportation
Location of Services:	Mulherin Creek, Montana
Contact Person:	Dr. Joel Cahoon
Telephone Number:	(406) 994-5961
Date(s) of Services:	2004 to present
Key Personnel:	Matt Blank

Sediment Transport Modeling at Milltown Dam

Mr. Blank supported the development of a sediment transport model using HEC-6. The model was used to assess different dam breaching scenarios for Milltown dam located near Missoula, Montana. A total of eight different modeling scenarios were studied to determine scour depths above the dam, total volume of sediment mobilized and downstream total suspended solids (TSS) concentrations resulting from dam breaching. The model estimated TSS concentrations were compared to field water quality samples to generate regression relationships for metals and other contaminants in the sediments stored in the reservoir above Milltown dam. These regression equations were used to estimate water quality at the downstream point of compliance for the breach scenarios.

Reference Information

Company Name:	Land and Water Consuulting Services (now PBS&J)
Location of Services:	Clark Fork River, Missoula, Montana
Contact Person:	Kevin Germain
Telephone Number:	(406) 580-6986
Date(s) of Services:	June 2003
Key Personnel:	Matt Blank

Kodiak Island Groundwater Study

OASIS evaluated historical groundwater data collected at the Kodiak Island Borough (KIB) Landfill in Kodiak, Alaska. The evaluation was performed in compliance with State of Alaska Solid Waste regulations (18 Alaska Administrative Code [AAC] 60).

Groundwater data from the KIB Landfill were evaluated in accordance with 18 AAC 60.830 using ProUCL and ChemStat, statistical applications for the analysis of groundwater monitoring data. Data from two KIB compliance wells were compared to data from a background well using EPA- and ADEC-approved tolerance limit procedures. A tolerance limit was constructed from background data and each compliance well sample was compared to the tolerance limit. If the compliance well sample exceeded the tolerance limit, the sample shows statistical evidence of contamination. The background upper 95% tolerance limit (UTL95) concentration was calculated for each detected analyte in the background data set. Per agency guidance, non-detects were replaced with ½ the practical quantitation limit (PQL). Compliance well data were analyzed by different statistical tolerance limit methods based on the frequency of analyte detection and best-fit distribution (normal, lognormal, or non-parametric).

Reference Information

Company Name:	Alaska Department of Environmental Conservation (ADEC)
Location of Services:	Kodiak, Alaska
Contact Person:	Derek Sjostrom
Telephone Number:	(907) 269-7626
Date(s) of Services:	January-March 2005
Key Personnel:	Eppie Havel Max Schwenne

King Salmon Background Metals/Radionuclides Determination

OASIS calculated groundwater and wetland (surface water and sediment) background concentrations for metals and radionuclides for a DoD site at King Salmon, Alaska. Consistent with state and federal guidance, the background upper 95% tolerance limit (UTL95) concentration was calculated for each analyte in the background data based on the best-fit distribution and the frequency of detection.

Reference Information

Company Name:	611th CES/CEVR
Location of Services:	King Salmon, Alaska
Contact Person:	David Hertzog
Telephone Number:	(907) 552-7261
Date(s) of Services:	March 2005
Key Personnel:	Eppie Havel
	Max Schwenne

Analytical Laboratory Services

OASIS Environmental, Inc. is not submitting qualifications for this service category.

DEQ Electronic Data/Information Technical Assistance

References

Table 0.24 provides applicable projects and references that have used and/or are using services similar to those requested by the State of Montana in the RFP. The references include State and Federal government, non-profit organizations, and private companies.

Company Profile and Experience

Please reference our general company profile presented in Section 0.

Method of Providing Services & Quality Assurance

OASIS personnel are experts in data management. OASIS consistently works on projects involving automated data extraction, formatting, data migration and normalization, and construction of batch file processing programs to facilitate automated data management tasks. In addition to the standard data management tasks listed above, OASIS is highly proficient in database application design and programming, allowing us to design and construct powerful front-end applications with user friendly graphical user interfaces (GUI). These front-end applications have been delivered as simple Visual Basic Windows and Microsoft Access applications, to more complex web applications written in active server page (ASP) web application technology. Most recently, all of OASIS' data management applications have been written using C# and the .NET application architecture, whether using standard Windows application interfaces or ASP.NET web application interfaces. We consider data management to be one of the most important day-to-day tasks we perform.

OASIS' data specialists are highly proficient in the SQL programming language used in database administration and can effectively tailor any dataset challenge into a working solution. OASIS has successfully designed and constructed databases and front-end applications working with SQL Server, Oracle, FoxPro, and Microsoft Access databases. Some of these applications required a great deal of data migration and normalization tasks from other data applications, including simple spreadsheets (Excel, Lotus), HTML, or delimited text files. OASIS possesses the capability and communication skills in order to recognize a data management challenge, and effectively translate the technical aspects of an application to users ranging from those with limited computer skills, to highly proficient programming/coding specialists.

OASIS is very familiar with the use and architecture of EPA's STORET water quality system. We have the competence to provide the services and support required by this service category. Our staff is able to migrate datasets to production database system(s) and improve data flow and data quality from a variety of sources into STORET.

Staff Qualifications

Table 0.23: Staff Qualifications – DEQ Electronic Data/IT Assistance

Staff Name	Degree(s)	Professional Registration(s)	Professional Experience (years)	Similar Project Experience (years)	Team Role
Nathan Sande	BS-Sociology/Natural Science MS-Environmental Science		11	8	PM/TC
Eppie Havel	BS-Environmental Studies MS-Environmental Quality Science		11	6	SS
Susan Ives	BS-Biology		3	2	SS
Jeannette Romig	B.S.-General Science M.S.-Earth Science		6	2	SS

Notes: PM - Project Manager; TC – Technical Coordinator; SS – Support Staff

Table 0.24: Projects/References – DEQ Electronic Data/IT Assistance

Electronic Data Deliverable (EDD) Database Repair and Data Migration

OASIS personnel supported the United States Army Engineer District (USAED) and their prime contractor, Jacobs Engineering Group, in retrieving and migrating sampling and analytical data from damaged and/or corrupt FoxPro and Oracle databases and associated records.

Reference Information

Company Name:	Jacobs Engineering Group
Location of Services:	Anchorage, AK
Contact Person:	Gloria Beckman (formerly with Jacobs Engineering Group)
Telephone Number:	(907) 348-0579
Date(s) of Services:	1997 to 2001
Key Personnel:	Nathan Sande

Over a four-year period, OASIS recovered thousands of sampling and analytical data records intended for migration into laboratory information management systems (LIMS) for subsequent electronic data deliverable generation. The databases (and their associated database application) were used in the field by sampling technicians to generate chain-of-custody (CoC) records and gather/store environmental field data and testing parameters from specific samples, intended for seamless integration into the project laboratory's LIMS and overall EDD construction.

Data entry errors, database application limitations, and user knowledge restrictions created orphan records and corrupted databases containing key information for successful upload into the laboratory LIMS. OASIS analyzed the database tables and relationships, constructed custom SQL queries, and reconstructed orphaned and/or corrupted data in order to produce a useful, recovered database deliverable. The databases and associated records were migrated in a format acceptable by the laboratory LIMS and the United States Army Corps of Engineers Loading Tool (COELT).

Electronic Chain-Of-Custody Application

OASIS designed and constructed a custom Microsoft Access database application named "eCoC." The eCoC Application (eCoC) is an event-driven database application that was designed with the intent of simplifying management and transmission of sample/chain-of-custody (CoC) data. The eCoC application facilitates efficient entry and maintenance of project sampling data, and electronic chain-of-custody (CoC) generation. The application was built from the ground-up to allow our client (BP), their contractors, the project laboratories, and the data validation contractor to devise a more streamlined approach to electronic CoC and sampling data management.

Reference Information

Company Name:	BP Exploration Alaska, Inc
Location of Services:	Various Alaska Locations
Contact Person:	Jim Chatham
Telephone Number:	(907) 564-4554
Date(s) of Services:	2003 to present
Key Personnel:	Nathan Sande Jeff Leety

Other electronic CoC programs were available for use, but almost all subscribed to a complex and difficult-to-manage framework largely based upon U.S. Army Corps of Engineers specifications. This detail was largely unused and unnecessary for most private and State clients, and cluttered the overall sample data management process. The eCoC was designed to provide similar functionality of these programs, yet using a simpler, more streamlined data management approach to sample data QA/QC.

In its most basic form, the application performs four important sample management tasks:

- Streamlined sample data management for use with multiple projects;
- Automatic CoC generation;
- Automatic generation of electronic CoC report files for electronic transmission to the project laboratory and data validation contractor; and,
- Automatic label generation for sample bottles and jars.

The eCoC application is in its second year of use in 2005. OASIS successfully managed over 8,000 discrete sampling records using eCoC in 2004. Improvements to the overall system are continuously being implemented.

Alaska Clean Water Actions Database Application

OASIS supported development of a decision tree for the Alaska Department of Environmental Conservation's (ADEC) Alaska Clean Water Actions (ACWA) program. The ACWA Decision Tree diagrams the flow of information, pathways and critical decision points for the application of key criteria associated with a decision.

Reference Information

Company Name:	Alaska Department of Environmental Conservation (ADEC)
Location of Services:	Alaska
Contact Person:	Jeff Hock
Telephone Number:	(907) 465-5274
Date(s) of Services:	2003 to present
Key Personnel:	Pat Athey Nathan Sande Sue Ives

The decision tree outlined a process to perform the following tasks:

- Determine if waterbodies are adequately protected;
- Identify and prioritize waterbodies-at-risk for additional protection action;
- Identify and prioritize waterbodies needing recovery for restoration or remedial action.

The program utilized input from the public and watershed stewardship groups to enable the process. The decision tree was separated into three phases; the Nomination Phase, the Analysis Phase, and the Action Phase.

In the Nomination Phase, individual waterbodies nominated by the public and agencies are reviewed and entered into the ACWA database (or returned to the nominator for additional information). The public had the opportunity to nominate waterbodies for inclusion into the program using a simple web entry form (http://info.dec.state.ak.us/awq/awca/waterbody/acwa1_interface/Results/submission_form.asp). This information was migrated into a database application designed and constructed by OASIS, named the ACWA Waterbody Management Tool.

In the Analysis Phase each waterbody is analyzed to determine:

- Whether existing stewardship programs are adequate to maintain and protect the waterbody;
- Whether available data is sufficient to determine the existence or extent of a current or potential problem.

The analysis phase directs waterbodies to three possible actions or outputs:

- Waterbodies that are adequately protected;
- Waterbodies requiring additional data;
- Waterbodies that require additional protection or recovery.

Waterbodies-at-risk and waterbodies needing recovery are addressed in the Action Phase by:

- Prioritizing individual waterbodies for action;
- Identifying and implementing protection or recovery actions;
- Evaluating the success of protection/recovery actions and directing the waterbody for additional information, continued monitoring or additional protection/recovery actions.

During all phases, additional data needs may be identified, sending the waterbody to the data collection track.

The database application (ACWA Waterbody Management Tool) designed and constructed by OASIS allowed automated movement of a nominated waterbody through the decision tree process, utilizing inputs within each of the three (3) decision tree phases and providing an overall priority ranking for required waterbody actions. Specific data about the waterbody (analytical results, TMDL plans and reports, hydrologic unit codes, etc.) were carried through the process allowing a comprehensive look at a waterbody and where it sat in the evaluation and ranking process. The holistic presentation of information within the management tool allowed OASIS to perform data adequacy and ranking evaluations based upon the data available and loaded into the tool.

OASIS constructed a GIS application developed in ArcGIS 9.0 to present all of the information collected in the database using a geographical map interface.

Kenai River Hydrocarbon Study Database Application

A custom database application was designed and constructed to minimize the time required by technical personnel to gather and correlate USGS and NOAA real-time river and weather data with sampling events and electronic laboratory data. The database application automatically linked to USGS and NOAA real time monitoring data site on the internet for the Kenai River and local weather stations each time the database application was updated with sampling data. The dates and times from each sampling event were automatically correlated with the nearest recorded real-time river and monitoring event from respective USGS and NOAA websites. Data from four (4) USGS real-time monitoring stations on the Kenai River were automatically queried, including station gage height and discharge, water temperature, and daily precipitation amounts. Local weather station data included daily precipitation, average daily air temperature, and dewpoint.

Reference Information

Company Name:	Alaska Department of Environmental Conservation (ADEC)
Location of Services:	Kenai, Alaska
Contact Person:	Tim Stevens
Telephone Number:	(907) 269-7515
Date(s) of Services:	2003-2004
Key Personnel:	Nathan Sande Sue Ives

Sample analytical results from laboratory electronic data deliverable (EDD) electronic files could be located and automatically imported into the database to construct a dataset that was more manageable, thus making data analysis more efficient. Field data measurements of pH, dissolved oxygen, conductivity, turbidity, salinity, and temperature accompanying each sample collection event were input by the field team and automatically tied to sample analytical results from the laboratory EDDs, subsequently correlated with acquired USGS and NOAA real-time data. SQL programming code was constructed to export data in delimited text files according to Alaska Department of Environmental Conservation's "Water Quality Monitoring Electronic Data Deliverable Format and Submittal Guidance" document for seamless transition into the STORET data repository.

The database application allowed for streamlined statistical trend analysis using multivariate regressions, comparing real-time stream, weather, and field measurement parameters with analytical results imported into the database. Specific application functions were constructed to complete automated data validation tasks to ensure data quality objectives were met. Use of the database application saved hundreds of hours in data upload, conversion, and migration tasks, producing a single dataset providing streamlined reporting and data analysis.

Landfill Ranking Model Application

OASIS designed and constructed a Landfill Ranking Model and web/database application to aid Alaska Department of Environmental Conservation in ranking and assessing risks to human health and the environment at existing unpermitted Alaskan landfill sites, and facilitating evaluation of proposed landfill sites. The project required derivation of an algorithm to adequately collect and weigh various factors related to three primary axes: Land Use/Receptors; Environmental Setting; and Waste Characteristics. Factors within the axes included various parameters that carried a numeric score, which were then loaded into the algorithm to yield an overall score for landfill site evaluations entered into the application. Factors evaluated in the algorithm included the following:

Reference Information

Company Name:	Alaska Department of Environmental Conservation (ADEC)
Location of Services:	Anchorage, AK
Contact Person:	Jennifer Roberts
Telephone Number:	(907) 269-7553
Date(s) of Services:	2003
Key Personnel:	Max Schwenne Nathan Sande

Land Use/Receptors
- ✓ Population
- ✓ Residential
- ✓ Subsistence Use
- ✓ Airports
- ✓ Surface Water Use
- ✓ Groundwater Risk
- ✓ Groundwater Use
- ✓ Fish
- ✓ Birds
- ✓ Mammals
- ✓ Streams/Lakes

Environmental Setting
- ✓ Soil Type
- ✓ Depth to Bedrock
- ✓ Fractured Bedrock
- ✓ Wetlands
- ✓ Erosion
- ✓ Air Transport Potential
- ✓ Rainfall
- ✓ Floodplains

Waste Characteristics
- ✓ Landfill Area
- ✓ Leachate Composition
- ✓ Special Wastes

The web application was constructed using Active Server Page (.asp) web programming technology, writing to a Microsoft SQL Server 2000 database residing on an OASIS web server. The application allowed ADEC regulatory personnel to test the ranking model algorithm in the application's beta-testing stages, as well as input data in a single database repository without the challenges of coordinating distribution of the algorithm, testing input files, and output reports from each landfill evaluation. Use of a web application enabled real-time input and report viewing so that other ADEC project managers could collaborate with one another remotely while viewing the same data.

Heavy Equipment Operators

OASIS Environmental, Inc. is not submitting qualifications for this service category.

Revegetation Services

References

Table 0.26 provides applicable projects and references that have used and/or are using services similar to those requested by the State of Montana in the RFP. The references include State and Federal government, non-profit organizations, and private companies.

Company Profile and Experience

Please reference our general company profile presented in Section 0.

Method of Providing Services & Quality Assurance

OASIS' primary subcontractor, ADC, has successfully completed dozens of riparian and upland revegetation projects throughout the State of Montana. A unique service provided by ADC is its *Native Plant Nursery*. Aquatic and upland material are grown and maintained in over 4,000 ft^2 of climate controlled greenhouse space, and over ten acres of riparian shrub and tree production areas. ADC's greenhouse operation can maintain and grow site-adapted inventory for the Northern Rocky Mountain Region. Nursery services include: harvesting native seed or collection of native stock, growing plants to requested specifications, hardening off and delivering plants to a project site, as well as creating and implementing restoration designs using native plants. ADC also produces pre-vegetated coir fabric mattresses for areas with high energy and erosion potential and where a more immediately restored look is required. The facilities include full-spectrum grow lights, propagation and germination chambers and a heating system for winter growing. ADC's field operation includes machines such as low-pressure tracked loaders, specialty willow planting equipment and hydro-seeding capabilities. Planting survival rates and exemplary plant performance on projects are directly attributed to key ADC personnel and our quality products.

ADC is highly experienced in managing the following areas of a successful revegetation project:

- ✓ Plant Survival Enhancement Techniques
- ✓ Plant Propagation and Quality Procedures
- ✓ Identification of Optimal Plant Placement Areas
- ✓ Identification of Optimal Planting Periods
- ✓ Preparation of Seed Collection Zones
- ✓ Careful Plant Handling and Transportation Methods
- ✓ Post-Planting Quality Control
- ✓ Innovative Solutions to Manage Uncontrollable Variables (site access, frozen ground, drought, etc.)

Staff Qualifications

Table 0.25: Staff Qualifications – Revegetation Services

Staff Name	Degree(s)	Professional Registration(s)	Professional Experience (years)	Similar Project Experience (years)	Team Role
Russell Smith	B.A., Environmental Conservation A.A.-Building Construction		12	10	PM/TC
Jeannette Romig	B.S.-General Science M.S.-Earth Science		6	3	SS
Meghan Mutch	B.S., Horticulture	Certified Plant Professional In Training	6	6	SS
Max Hjortsberg	B.A., History		3	3	SS

Notes: PM - Project Manager; TC – Technical Coordinator; SS – Support Staff

Table 0.26: Projects/References – Revegetation Services

Jack Creek Ranch Wetland/Stream Mitigation

An extensive wetland mitigation supplied wetland credit to MDOT for road building activities in Madison County. The goals of this project were to restore over 9,300 ft of spring creek channel, restore hydrology to over 80 acres of wetlands, and to revegetate all disturbed areas with native wetland shrubs and grasses.

For the revegetation goals of the project, ADC custom grew (in our nursery facilities), delivered and installed approximately 58,600 sedge and rush plugs, and planted approximately 4,000 woody and herbaceous plants across the project; in addition, wetland and upland seed was broadcast across the disturbed areas.

The revegetation strategy included on-site transplants and seed collections, which were brought back to the growing facility and propagated. Through 2006, ADC will continue the established monitoring program and plant more woody and herbaceous transplants as necessary to ensure the projects' revegetation goals are achieved.

Reference Information

Company Name:	Jack Creek Ranch & MDT
Location of Services:	Jeffers, MT
Contact Person:	Larry Urban, MDT Rick Webel, Land Owner
Telephone Number:	Larry Urban (406) 444-6224 Rick Webel (516) 674-4200
Date(s) of Services:	2003 – present
Key Personnel:	Tom Coleman Russell Smith Jeannette Romig Max Hjortsberg

Renaissance Ranch Stream Restoration

ADC Services was retained by Mr. Todd to restore a 2,500-foot reach of Pool Creek, a Yellowstone River tributary. Services provided at the Renaissance Ranch included streambank stabilization, in-stream habitat improvements, complete channel creation, creation of a six-acre lake and project area revegetation.

An ADC Revegetation Team completed all the planting, seeding and cuttings utilizing either on-site transplants, or nursery stock from the ADC Nursery. A wetland sod borrow site was evaluated near the stream corridor. Desirable wetland species were identified and approximately 1,500 ft2 of wetland sod mats were excavated, transplanted and used in the construction of the newly aligned channel banks. Beyond the immediate bank areas where sod was used, the over-bank areas were planted with nearly 10,000 containerized wetland plugs and seeded with an appropriate native seed mix. A total of approximately 1.75 acres of riparian wetlands were restored along the stream corridor.

Reference Information

Company Name:	Renaissance Ranch
Location of Services:	Park County, MT
Contact Person:	Dan Todd
Telephone Number:	(732) 450-8974
Date(s) of Services:	2000
Key Personnel:	Tom Coleman Russell Smith

East Catron Stream Restoration

The Gallatin Center, LLP retained ADC Services, Inc. to relocate and enhance a straightened and channelized reach of East Catron Creek in Bozeman, Montana. ADC worked closely with MT Fish Wildlife & Parks (FWP) and the developer to create a working configuration for creek relocation, which fit within a meander corridor specified by the developer and increased stream length and fish habitats required by the permitting agencies.

ADC provided oversight on the project from initial planning through construction and revegetation. The revegetation plan included seed collection, propagation, transplanting, maintenance, delivery and the planting of obligate wetland plants through the transitional zone. These plantings included native rushes and sedges (over 2,700 plugs), willow, dogwood, cottonwood, aspen (over 275 saplings) and upland forbs and wildflowers. In order to out-compete invasive species such as Reed Canary Grass, the stream banks were planted at ½ foot and smaller intervals for quicker vegetative establishment.

Reference Information

Company Name:	Gallatin Center LLP
Location of Services:	Bozeman, MT
Contact Person:	Gene Graff
Telephone Number:	(406) 587-7650
Date(s) of Services:	May1998 – present
Key Personnel:	Tom Coleman Russell Smith

Cloud Ranch Stream/Wetland Mitigation

ADC developed a stream and floodplain restoration plan for the impacted reach of Big Timber Creek. The channelized segment of the creek was restored to a more sinuous pattern consistent with an upstream reference reach. Created over-bank areas and associated point bars were densely vegetated with 7,400-willow cuttings and custom grown cottonwoods. During the channel realignment the artificial dikes were removed, allowing the floodwaters to spread out, re-connecting the channel to its floodplain. Additionally, several artificial ponds were restored to include emergent wetlands. Adjacent upland areas were graded to convert the areas to wetlands. ADC's Native Nursery custom grew 12,500 native wetland sedge, rush, and bulrush plugs for this portion of the project and our revegetation team successfully implemented the revegetation design to meet project goals. As a result of these restoration efforts, 5.5 acres of riparian and emergent wetlands were restored on the bottomland of Big Timber Creek. Wetland banking credits were accepted by and sold to Montana Department of Transportation.

Reference Information

Company Name:	Cloud Ranch & MDT
Location of Services:	Big Timber, MT
Contact Person:	Larry Urban, MDT Tom Hintz, FWP John Heminway, Land Owner
Telephone Number:	Larry Urban (406) 444-6224 Tom Hintz (406) 994-7889 John Heminway (917) 842-9799
Date(s) of Services:	2002-2003
Key Personnel:	Tom Coleman Russell Smith Max Hjortsberg

Fleshman Creek Restoration

The City of Livingston retained ADC Services Inc. to restore a degraded section of Fleshman Creek that had become an over-widened slough from downstream beaver activity. ADC performed the topographic survey, designed and constructed the restored channel, as well as designed and implemented the revegetation portion of the Fleshman Creek Restoration project. Through a cooperative effort of the Joe Brooks Chapter of Trout Unlimited, the National Park Services, and the City of Livingston a new narrowed channel was designed and constructed over a 2,200 ft reach. The construction resulted in over an acre of newly constructed flood plain. ADC's Native Nursery custom grew the vegetation necessary to restore the plant community for 2,200 feet of streambank and 1.2 acres of adjacent floodway. Approximately 1,000 willow cuttings, 3,000 wetland plugs and 180 riparian shrubs were grown, delivered, and installed by the ADC revegetation team with the help of over 300 Livingston middle school student volunteers. In addition, all disturbed areas were covered with topsoil and seeded with a native riparian seed mix and native upland seed mix.

Reference Information

Company Name:	City of Livingston
Location of Services:	Livingston, MT
Contact Person:	Gary Weiner, NPS Steve Golnar, City of Livingston
Telephone Number:	Gary Weiner (406) 587-1667 Steve Golnar (406) 222-2005
Date(s) of Services:	Spring 2004-present
Key Personnel:	Tom Coleman Russell Smith Jeannette Romig Max Hjortsberg

Watershed Coordination

OASIS Environmental, Inc. is not submitting qualifications for this service category in order to remove limitations upon competing for projects under the jurisdiction of watershed groups this service may be performed for.

Communication/Educational Services – Information & Education

OASIS Environmental, Inc. is not submitting qualifications for this service category.

Communication/Educational Services –Contract Administration

OASIS Environmental, Inc. is not submitting qualifications for this service category.

Communication/Education Services – Information Transfer & TMDL Technical Editing

References

Table 0.28 provides applicable projects and references that have used and/or are using services similar to those requested by the State of Montana in the RFP. The references include State and Federal government, non-profit organizations, and private companies.

Company Profile and Experience

Please reference our general company profile presented in Section 0.

Method of Providing Services & Quality Assurance

Since its incorporation in 1995, OASIS has developed numerous of community outreach documents and products to deliver information to target audiences. Several high-profile projects which OASIS has been actively involved have required controversial actions that regulatory agencies and/or private clients have requested our services to design, construct, and deliver clear and effective presentations and collaborative documents to explain difficult concepts in layman's terms. Similarly, OASIS has worked closely with regulatory agencies in drafting regulations and providing guidance documents to discuss and explain their application and use.

OASIS' technical staff is highly proficient in document editing, graphic layout, and website design, and aim to provide a clear and concise message by utilizing a well-organized presentation. The communication medium of choice is determined by the audience and required distribution of the information, whether through use of internet websites, CD-based websites, Microsoft PowerPoint© presentations, video presentations, or hard copy brochures and manuals. OASIS has completed numerous successful projects utilizing each of the methods described above.

OASIS is also very competent in technical editing and document review – we have held contracts with State and Federal agencies to review document submissions ranging from general work plans, human health & ecological risk assessments, to water quality best management practices (BMPs).

OASIS' staff are leaders in their respective fields of discipline relied upon for their technical expertise and scientific knowledge. This knowledge and expertise is the direct result of our ongoing training, education and continuous interaction with state and federal agency personnel, united with direct field application. OASIS' staff are routinely featured presenters within their fields of technical expertise. As a result OASIS is highly qualified to provide communication and education services and technical editing services.

Table 0.27: Staff Qualifications – Information Transfer & TMDL Technical Editing

Staff Name	Degree(s)	Professional Registration(s)	Professional Experience (years)	Similar Project Experience (years)	Team Role
Max Schwenne	BS-Chemical Engineering MS-Environmental Engineering		23	16	PM
John Gangemi	BS-Natural History MS-Environmental Studies		15	11	TC
Eppie Havel	BS-Environmental Studies MS-Environmental Quality Science		11	5	SS
Jane Paris, EIT	BS-Geophysical Eng. MS-Agricultural Eng.(Hydrogeology)	Engineer In Training (EIT)	17	11	SS
Nathan Sande	BS-Sociology/Natural Science MS-Environmental Science		11	6	SS
Russell Smith	B.A., Environmental Conservation A.A.-Building Construction		12	3	SS

Notes: PM - Project Manager; TC – Technical Coordinator; SS – Support Staff

Table 0.28: Projects/References – Information Transfer & TMDL Technical Editing

Risk Assessment Reviews

These projects demonstrate OASIS experience performing risk assessment reviews and completing technical editing services. Each risk assessment is different; however risk assessments and closure documents must be consistent with state and federal regulations and guidance. Work performed on these projects shows that OASIS personnel are responsive to the specific needs of each ADEC project manager and each project, yet able to ensure that documents are consistent with ADEC policy and state requirements. OASIS key personnel for these risk assessment review projects include Max Schwenne (Project Director), Krista Graham (Project Manager and Risk Assessment Review Lead), Jane Paris (Hydrogeology/Model Review), and Eppie Havel (Risk Assessment Review).

Reference Information

Company Name:	Alaska Department of Environmental Conservation (ADEC)
Location of Services:	Anchorage, AK
Contact Person:	Gretchen Pikul
Telephone Number:	(907) 269-3077
Date(s) of Services:	2000 to 2004
Key Personnel:	Max Schwenne Krista Graham Jane Paris Eppie Havel

Project Description: OASIS performed reviews for risk assessment work plans and/or risk assessments for sites at Northeast Cape, Ted Stevens International Airport, Big Mountain Radio Relay Station, Indian Mountain Long Range Radar Site, Nikolski Radio Relay Station, Mud Pit Release Sites at Amchitka, Ratz Harbor Former Logging Camp Site at Prince of Wales Island, East 12-Mile Dump Site at Prince of Wales Island, and Adak Naval Air Station. Work performed for these projects included the following tasks:

- Ensured that the risk assessment was consistent with ADEC and EPA guidance;
- Evaluated the data to confirm that the data were adequate for using risk assessment as a site closure option;
- Confirmed that the exposure assessment was protective of current and future site receptors;
- Reviewed statistical analyses and risk characterization calculations for accuracy;
- Recommended “acceptance” or “no acceptance” for documents and provided recommendations and justification for modifications to documents;
- Provided technical support to the Department during the review process; and
- Participated in review conferences and meetings with other parties to address questions and comments raised during document reviews.

Each of these projects included the tasks listed above; however, each project had unique priorities and specific review requirements. For example, the Ted Stevens International Airport project involved a more rigorous evaluation of the statistics used to determine if the methods used were appropriate and applied correctly. The Adak Naval Air Station project included numerous sites and was conducted over a year-long time frame. These reviews were very complicated and required creativity and flexibility. Comment resolution with the responsible party and their consultants was difficult and became confrontational. The ADEC project manager changed during the project. OASIS helped maintain continuity and provided technical support to assist the new project manager to efficiently move the project forward. Ultimately OASIS and the Department determined that risk assessment closure was not appropriate for many of the sites. OASIS created a matrix to assist the ADEC project manager to identify a streamlined methodology for closure of the sites that was consistent with ADEC policies and technically sound.

Montana Watercourse Workshops

Russell Smith has worked with the Montana Watercourse in their series of community adult education workshops. These workshops included PowerPoint presentation and tours of local wetlands and active ADC wetland restoration projects. In these, stakeholders were exposed to active wetland restoration and educational opportunities through on-the-ground walking tours. Participants typically include interested community members, as well as agency personnel, fellow consultants and practitioners.

In addition, Russell sat on Montana Watercourse’s Pond Advisory Committee which was organized for the purpose of generating the publication: A Guidebook for Montana Ponds. This publication was published to help landowners make informed decisions regarding the potential benefits and negative impacts of creating an aquatic amenity.

Reference Information

Company Name:	Montana Watercourse
Location of Services:	Southwest Montana
Contact Person:	Michelle LeBeau & Karen Filipovich
Telephone Number:	(406) 994-1910
Date(s) of Services:	2003-2004
Key Personnel:	Russell Smith

Technical and Legal Services for Alaska NPDES Primacy

OASIS developed draft statutes and regulations suitable to allow the State of Alaska to assume primacy for the NPDES program. The project included the following five objectives: 1) preparation of a layperson's summary of Alaska State statutes and regulations required to comply with the requirements of the federal Clean Water Act (CWA) to assume primacy of the NPDES program; 2) preparation of draft language for the statutes and regulations Alaska will need to adopt to assume primacy of the NPDES program; 3) assistance with presentation(s) to interested stakeholders; (4) identification of technical expertise and staff training needs for implementing the NPDES program; and (5) canvassing other states for innovative permit streamlining efforts and identifying suggested statutory and regulatory language. ADEC gave OASIS notice to proceed in the spring of 2003. All objectives were met or exceeded by OASIS. Revised drafts of the legislation and regulations were delivered to ADEC in the fall of 2003. The state is seeking primacy for the NPDES program with a goal of having a state-run program in place by July 2005.

Reference Information

Company Name:	Alaska Department of Environmental Conservation (ADEC)
Location of Services:	Anchorage, AK
Contact Person:	Ms. Sharon Morgan
Telephone Number:	(907) 465-5530
Date(s) of Services:	2003-2004
Key Personnel:	Max Schwenne Jim Sweeney

Anchorage Jet Fuel Pipeline Project

OASIS served as the Permitting Agent responsible for several major tasks:

- Environmental evaluation document similar in scope and content to a NEPA EIS for large and controversial project located along Anchorage's waterfront.
- Hazard assessment (SARA Title III) for spill scenarios of eight potential pipeline routes and existing pipeline retrofit alternatives to move fuel to the airport.
- Impact assessment of pipeline on humans and the environment.
- Public participation process including public meetings, newsletters, flyers, community council and interest group presentations.
- Mapped and evaluated jurisdictional wetlands, habitats and sensitive areas for the selected pipeline route.
- Corps 404/10, ACMP, ADFG Title 16 permit applications and agency negotiations.
- Construction-reclamation plan and compensatory mitigation plan.
- Chaired bimonthly meetings for the project work group that included agencies, special interest groups, and the public.
- Media interviews including live radio talk shows, local television stations, newspaper, and magazines.

Reference Information

Company Name:	CONAM Construction
Location of Services:	Anchorage, AK
Contact Person:	Bob Stinson
Telephone Number:	(907) 278-6600
Date(s) of Services:	1997-1999
Key Personnel:	Pat Athey

The project required development of several original documents including the Potential Construction and Operations Impact, ACMP Project Description, Corps and ADFG Permit Applications, and the Oil Spill Contingency Plan/Construction-Reclamation Plan. The project was under severe time constraints; consequently, comprehensive technical documents were produced in two or three weeks. These documents required extensive research and dozens of interviews with subject matter experts. The documents represented the most current and detailed evaluation of the mudflat environments, potential affects of an oil spill, statistical analysis, and compilation of references. OASIS has extensive experience in providing public and community relations, and routinely coordinate meeting facilities, record meeting minutes and distribute newsletters and project updates.

OASIS was able to prepare all the documentation needed to satisfy permitting requirements and address the concerns of the public, special interest groups, and resource agencies in a timely manner. The permitting was completed and the final permits were awarded on schedule. The pipeline was constructed in the fall of 1998, and OASIS continues to monitor site restoration and revegetation.

Stakeholder Facilitation, Collaborative Processes and Coalition Building in FERC Hydropower Proceedings

The Federal Energy Regulatory Commission oversees the process of relicensing private hydropower dams. Licenses are issued for periods of 30 to 50 years. The allocation of limited water supplies to continued power generation purposes verses instream flow for fisheries and recreation purposes makes the 5 year hydropower relicensing process highly contentious. Stakeholders with diverse interests compete for the limited water to satisfy their interests.

Reference Information

Company Name:	American Whitewater
Location of Services:	National
Contact Person:	Kevin Colburn
Telephone Number:	(208) 882-2711
Date(s) of Services:	1997-2005
Key Personnel:	John Gangemi

There are three procedures available for relicensing a hydro project: 1) The Traditional Licensing Process; 2) the Alternative Licensing Process; and 3) the Integrated Licensing Process. In addition, any of these licensing processes may evolve into a parallel Settlement Negotiation complimentary to the FERC process. Regardless of the five year licensing procedure utilized, reaching a successful outcome (translated as receipt of new 30-50 year license free of litigation) requires establishment of collaborative protocols and stakeholder facilitation to resolve complex natural resource issues.

John Gangemi is a nationally recognized expert in the FERC relicensing process having participated in over one-hundred hydropower relicense proceedings. John pioneered use of the Alternative Licensing Process and Integrated Licensing Process throughout the western United States as well as successfully negotiated licensing settlements in California, Colorado, Idaho, Montana, Oregon and Washington. John is an invited participant in hydropower relicense proceedings because of his expertise building collaborative protocols among diverse stakeholder groups as well as stakeholder facilitation skills. John played a critical role establishing ground rules and collaborative protocols for the first web-based relicense proceeding. John has provided numerous presentations on collaborative processes to agency conferences, utility conferences, environmental granting foundations and conservation groups.

In recognition of his expertise establishing collaboratives and facilitation skills the Governor of Montana appointed John to the twenty-two member River Recreation Advisory Board. The River Recreation Advisory Council developed a guidance document for managing river-based recreation in the state. The guidance document was approved by the Montana Department of Fish, Wildlife and Parks.

John has served on the steering committee of the national Hydropower Reform Coalition, a diverse group of national, regional and state river conservation groups participating in FERC hydropower license proceedings. John was a founding member of the California Hydropower Reform Coalition and chaired the Pacific Northwest Hydropower Reform Coalition. John was a founding member of the Low Impact Hydropower Institute, a coalition of national, regional and state conservation groups focused on establishing criteria and a certification process for green-energy generated from hydro projects.

Land Use Planning Services

OASIS Environmental, Inc. is not submitting qualifications for this service category.

Preparation of Technical Manuals or Circulars

References

Table 0.30 provides applicable projects and references that have used and/or are using services similar to those requested by the State of Montana in the RFP. The references include State and Federal government, non-profit organizations, and private companies.

Company Profile and Experience

Please reference our general company profile presented in Section 0.

Method of Providing Services & Quality Assurance

OASIS' staff are leaders in their respective fields of discipline, and are relied upon by both government and private entities for their technical expertise and scientific knowledge. OASIS' staff have authored technical manuals in numerous environmental fields, including the following:

- ✓ **Health, Safety and Environment (HSE) System Implementation Manuals**
  - ➢ *ISO 14001 Environmental Management System (EMS) manuals and documents*;
  - ➢ *OHSAS 18001 Occupational Health and Safety Management System manuals and documents*
- ✓ **Computer Software User Manuals** for OASIS–designed and constructed software applications
- ✓ **Technical Implementation Manuals** focusing upon regulatory compliance or scientific principles
  - ➢ *Waste Management Manuals* describing proper management strategies with regards to RCRA and State-specific regulations, tailored to specific clients and/or industry practices
  - ➢ *Emergency Response Manuals* describing spill response and immediate remedial actions, including video presentation
  - ➢ *Scientific Guidance Manuals* describing risk assessment calculation guidance, revegetation procedures

OASIS' technical staff is highly proficient in document editing, graphic layout, and website design, and provide clear and concise guidance by utilizing a well-organized presentation. The communication medium of choice is determined by the audience and required distribution of the information, whether through use of internet websites, CD-based websites, Microsoft PowerPoint© presentations, video presentations, or electronic/hard copy brochures and manuals. OASIS has completed numerous successful projects utilizing each of the methods described above.

OASIS believes the most important task to perform prior to developing a technical manual or circular is collaborating with industry leaders to design a proper approach for delivery of the information and message. OASIS maintains strong relationships with agency personnel, private industry leaders, and other consultants. Gathering inputs from these relations while inventorying the level-of-understanding of various stakeholders and audiences must be completed to identify the proper approach to deliver technical information.

Table 0.29: Staff Qualifications – Preparation of Technical Manuals or Circulars

Staff Name	Degree(s)	Professional Registration(s)	Professional Experience (years)	Similar Project Experience (years)	Team Role
Jeff Leety	BS-Geology PGS-Hydrogeology		18	13	PM
Dave Trudgen	BS-Wildlife Biology & Management		28	21	TC
Pat Athey	BS-Botany MS-Botany		21	15	SS
Max Schwenne	BS-Chemical Engineering MS-Environmental Engineering		23	16	SS
Jane Paris, EIT	BS-Geophysical Eng. MS-Agricultural Eng.(Hydrogeology)	Engineer In Training (EIT)	17	11	SS
Nathan Sande	BS-Sociology/Natural Science MS-Environmental Science		11	6	SS

Notes: PM - Project Manager; TC – Technical Coordinator; SS – Support Staff

Table 0.30: Projects/References – Preparation of Technical Manuals or Circulars

Technical and Legal Services for Alaska NPDES Primacy

OASIS developed draft statutes and regulations suitable to allow the State of Alaska to assume primacy for the NPDES program. The project included the following five objectives: 1) preparation of a layperson's summary of Alaska State statutes and regulations required to comply with the requirements of the federal Clean Water Act (CWA) to assume primacy of the NPDES program; 2) preparation of draft language for the statutes and regulations Alaska will need to adopt to assume primacy of the NPDES program; 3) assistance with presentation(s) to interested stakeholders; (4) identification of technical expertise and staff training needs for implementing the NPDES program; and (5) canvassing other states for innovative permit streamlining efforts and identifying suggested statutory and regulatory language. ADEC gave OASIS notice to proceed in the spring of 2003. All objectives were met or exceeded by OASIS. Revised drafts of the legislation and regulations were delivered to ADEC in the fall of 2003. The state is seeking primacy for the NPDES program with a goal of having a state-run program in place by July 2005.

Reference Information

Company Name:	Alaska Department of Environmental Conservation (ADEC)
Location of Services:	Anchorage, AK
Contact Person:	Ms. Sharon Morgan
Telephone Number:	(907) 465-5530
Date(s) of Services:	2003-2004
Key Personnel:	Max Schwenne Jim Sweeney

Environmental Protection Manual, EN-43

EN-43 is Alyeska Pipeline's primary technical manual for providing environmental guidance to company employees. It provides guidance for a full range of environmental issues that can effect Alyeska's operations. These include air quality; water quality including drinking water and wastewater issues; fish, wildlife and archeological resources; land use; oil and chemical spill prevention and cleanup; and hazardous material management. The manual provides describes external permitting procedures and internal policies for each discipline. It is designed for easy use and written in clear concise language for the non-environmental professional. OASIS employees James Sweeney and David Trudgen participated in the original drafting of the manual while employed with Alyeska Pipeline and then updated the manual after joining OASIS.

Reference Information

Company Name:	Alyeska Pipeline Service Company
Location of Services:	Anchorage, AK
Contact Person:	Carl Rutz
Telephone Number:	(907) 787-8519
Date(s) of Services:	1996 and 2003
Key Personnel:	Dave Trudgen Jim Sweeney

Environment Unit Response Manual

OASIS developed an Environment Unit Response Manual to aid ConocoPhillips' Environment Team during an oil spill response. The oil industry utilizes the Incident Command System (ICS) during an oil spill response. The Environment Unit responsibilities during a spill response include permit acquisition, waste management, cultural resource identification and protection, air and water quality monitoring and wildlife protection, capture and cleanup. This guidance manual provides detailed checklists that serve as a reminder of the responsibilities expected from each member of the Environment Unit Response Team. They also help guide the team member through the steps necessary to complete an adequate response program. The checklists were produced and placed on a single CD and include imbedded links to items such as reference documents, blank and example permit applications, examples of completed monitoring and waste handling plans, wildlife response plans, response equipment locations and agency contact information.

Reference Information

Company Name:	ConocoPhillips Alaska Inc.
Location of Services:	Anchorage, AK
Contact Person:	Caryn Rea
Telephone Number:	(907) 265-6515
Date(s) of Services:	2004 to present
Key Personnel:	Dave Trudgen Lauri Bassett

Tundra Treatment Manual

OASIS completed an oil and hazardous material spill response tactic manual describing techniqes and strategies for restoring spill-affected tundra environments on the Norht Slope and other tundra areas of Alaska. Conducted extensive literature research and interviews with oil spill response and tundra restoration experts to establish scientifically-defensible methods for recovering or detoxifying crude oil and other spills while minimizing the impacts to soils and vegetation.

Reference Information

Company Name:	Alaska Department of Environmental Conservation (ADEC)
Location of Services:	Alaska
Contact Person:	Ed Meggert Bill Streever (BP)
Telephone Number:	Ed Meggert (907) 451-2124 Bill Streever (907) 564-5111
Date(s) of Services	1999 - 2000
Key Personnel:	Dave Trudgen Pat Athey

North Slope Plant Establishment Guidelines

OASIS completed the •*North Slope Plant Establishment Guidelines* a technical manual to guide revegetation efforts in the North Slope oil fields. Prepared for BP Exploration (Alaska) Inc. and ConocoPhillips Alaska, Inc. in 2004. The *North Slope Plant Establishment Guidelines Table* presents the recommended approaches for plant establishment at land rehabilitation sites on North Slope of Alaska.

The table was developed as a voluntary effort by BP Exploration (Alaska), Inc. and ConocoPhillips Alaska, Inc. to improve the consistency of North Slope land rehabilitation projects. The table provides recommendations for establishing plants in different North Slope land rehabilitation settings including thick gravel pads, gravel removal sites (with and without residual gravel), overburden, disturbed tundra, salt-affected tundra, coastal sites, and ponds. The table lists the recommended plant species, methods, planting rates, fertilizers, and season of planting for these settings, along with estimates of cover and species richness that are possible within 10 years after planting if the recommendations are followed. Additionally, the justification for the recommended treatments, example sites and reference citations for the treatments are included, along with supplemental notes about the recommended strategies. References and a table of planting rates for native plant seeds are also included. The table is structured to facilitate selection of appropriate plant establishment strategies over a wide range of conditions.

Reference Information

Company Name:	BP Exploration Alaska, Inc. ConocoPhilips Alaska, Inc.
Location of Services:	Alaska
Contact Person:	Bill Streever (BP) Caryn Rea (ConocoPhilips)
Telephone Number:	Bill Streever (907) 564-5111 Caryn Rea (907) 265-6515
Date(s) of Services:	2004 to present
Key Personnel:	Dave Trudgen Pat Athey